JANUARY 1956

Approach

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THE NAVAL AVIATION SAFETY REVIEW

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Approach

THE NAVAL AVIATION SAFETY REVIEW

JANUARY 1956

Vol. 1 No. 7

Prepared by the U.S. Naval Aviation Safety Center

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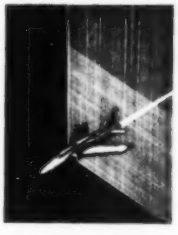
ON THE COVER—Through the barrier—that one-time never-never-land of sonic flight has become a well-traveled area as new aircraft probe the high speed regions with routine regularity.

Bill Cochran, Grumman test pilot presents an interesting discussion of some of the problems—and answers—in this phase of flight operations in "Ye Olde Sonic Walle," beginning on page 10.



Safety Council Notes

Helicopter Accident Committee, Lakehurst—A pilot who had not flown the HRS model for 11 months attempted to engage the main rotors with the wind coming from the starboard quarter. The main rotor flapped into the tail boom. It was felt that pilots should be checked out by an experienced pilot before being allowed to act as first pilot after a long layoff.

ComAirPac—The committee noted the case of an alert LSO who observed an aircraft to be on fire after a wave-off and by notifying the pilot to land immediately, contributed to the subsequent escape of the pilot without injury.

VMF (N)-531, Cherry Point—presented an outline of safety measures for night operations: (a) proper and prior instrument training, (b) caution during all taxiing,. (c) initial flights scheduled for the local area plus twilight take-offs to facilitate familiarization, (d) monitor initial landings of inexperienced pilots, (e) emphasis on using the standard day pattern at night without change.

Marine Training Group 20, Cherry Point—Stressed was the timely distribution of publications intended for maintenance personnel and insuring that publications reach the personnel.

CNABaTra—It was determined that the new type paint job (white and light grey) very effectively camouflages the command's F9Fs. It was then recommended that all training jet aircraft should be painted orange and white in accordance with BuAer Instruction NavAer 0.72. *Editor's Note: The new color scheme is a tactical improvement but users report that all pilots and air crews need to keep a sharper lookout to avoid mid-air collisions, especially in haze or smoke.*

FLogWing Pac—With the increasing number of reports relative to aircraft being serviced with contaminated fuel or accidentally mixed grades of fuel, the council recommended that all personnel concerned with fueling be periodically briefed on; (a) proper method of checking fuel sumps for contamination (sediment, water, or any foreign matter), (b) the correct color of fuel for the fuel grade used in a particular model aircraft. BuAer Technical Note 10-54 points out in paragraph 4(e) the factors affecting aircraft engine fuel quality.

A Goal for 1956

Military aviation is a hazardous occupation. The degree of hazard, however, is controllable through two major variables, material failure and personnel error. Personnel error accounts for a large portion of accidents, and is the area in which the largest gains in aviation safety can be attained—gains to which every naval aviator and aircrewman can contribute.

We have made safety progress in the past three years. But there is still room for improvement and this year should start with the firm conviction that each individual has a personal challenge to reduce the accident rate.

There are a number of ways of measuring relative safety of flight operations. Airline companies do so by computing the number of accidents or injuries per 100,000,000 passenger miles. In the Navy we record our safety progress by the number of accidents which occur per 10,000 aircraft flight hours, and the number of carrier landing accidents per 1000 landings.

I sometimes wonder, however, if pilots and airplane crews know what these rates mean when translated into lives and dollars. The record for the last three years is shown below:

These declining rates are gratifying, but they are only symbols of what has actually occurred. When related to the tremendous flight activity of the entire aeronautical organization, each decrease of one-tenth of a point in the major damage accident rate represents *an annual saving of about 10 lives and slightly over $5,000,000.*

Thus the improvement achieved in 1955 represents a saving of over $42,000,000, which would otherwise have been lost in destroyed or damaged airplanes. Even more important, it means that about 84 pilots and aircrewmen are alive today—men who would be lost to the Defense Organization and their families except for the progress of the aviation safety program.

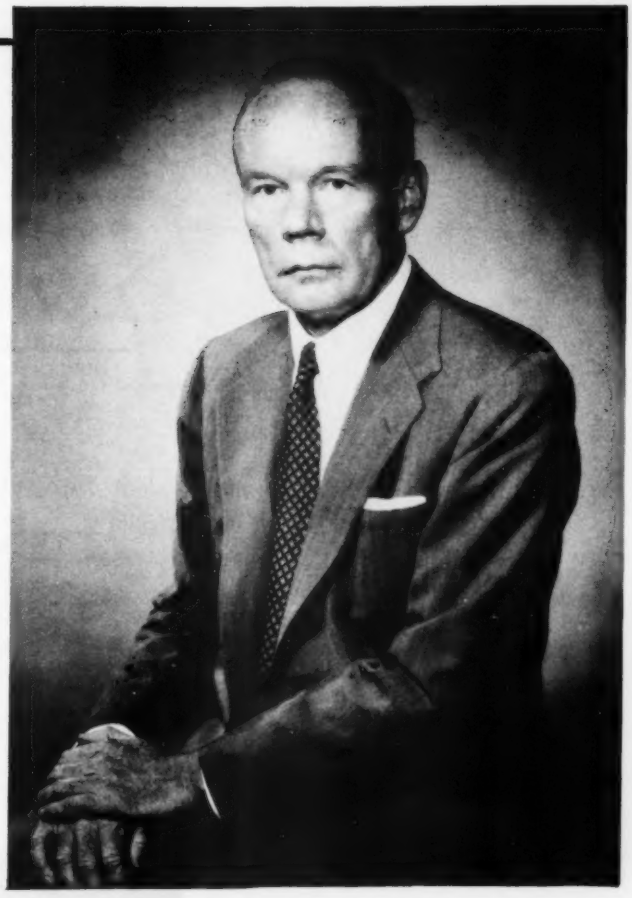
Each successive reduction in the aircraft accident

Calendar Year	Major Damage Accident Rates Per 10,000 Hours	Major Damage Rates Per 1000 Carrier Landings
1953	5.23	3.08
1954	4.42	3.28
*1955	3.58	2.40

*Note: 1955 figures are estimates based on the most accurate information available as of press time.

rate will be more difficult to achieve, but I am firmly convinced that we can and will continue the progress made in the last few years. The introduction of increasing numbers of angled-deck aircraft carriers should improve landing rates. Experience to date with the mirror landing system also appears very promising. By mid-1956 nearly 200 aviators will have received special training for duty as staff and squadron aviation safety officers with direct responsibility to implement and monitor the safety program. I predict that we can bring the major damage accident rate down very close to 3.0, and the carrier landing accident rate down to 2.0 in the coming year. The job will not be easy without the complete cooperation and superior effort on the part of every individual connected with naval aviation. The tangible savings in lives and equipment and the salutary effects on morale and readiness will be reflected in achievement.

Nineteen fifty-five was the safest year in the history of peacetime naval aviation. Let's make 1956 even safer.



The Honorable James H. Smith Jr.
Assistant Secretary of the Navy for Air

1955 SAFETY AWARD WINNERS

WITH this issue, the *Approach* begins a presentation of the winners of the Chief of Naval Operations Aviation Safety Awards for Fiscal 1955. Given in recognition of the achievement of operating, training and reserve aviation units and aircraft carriers with outstanding safety records, the Safety Award constitutes the highest honor of its nature in naval aviation.

These all-Navy awards are made to the following categories: Within each Fleet to the winning (a) jet aircraft squadron; (b) single pilot prop aircraft squadron; (c) helicopter squadron; (d) dual pilot aircraft squadron, and (e) aircraft carrier. Within CNATra to (a) jet aircraft training unit; (b) single pilot prop aircraft training unit; (c) dual pilot aircraft training unit. Within CNAResTra to (a) jet aircraft squadron; (b) single pilot prop aircraft squadron; (c) dual pilot aircraft squadron.

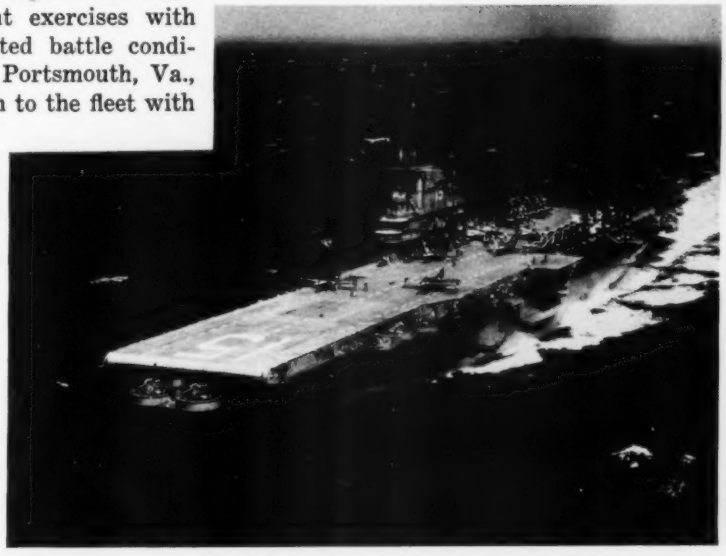
In this and succeeding issues, the *Approach* will present several of the winners of the 1955 award until complete coverage is accomplished.

To the winners of the Navy's highest aviation safety honor, the Naval Aviation Safety Center adds its own "Well Done." To all of the participating units is expressed the unqualified appreciation for a determined all-hands effort which is impressively reflected in a reduced aircraft accident rate.

For everyone concerned there is the advice that Fiscal 1956 is but half complete and there still remains time to make this year even safer!

USS RANDOLPH
CVA 15

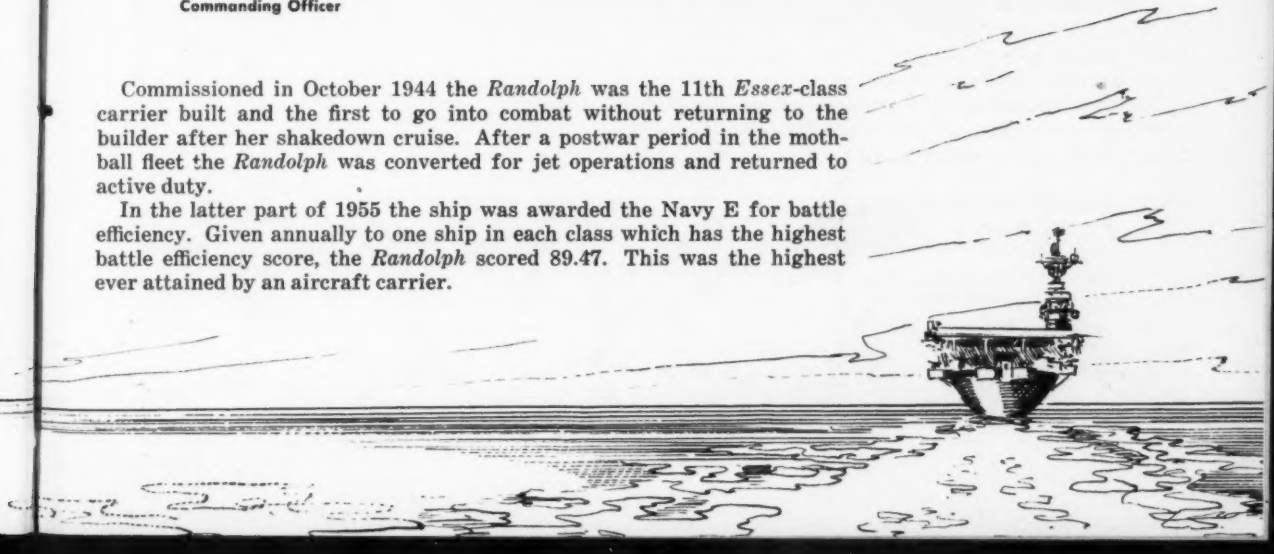
The 33,000-ton USS *Randolph* completed a seven-month cruise in June 1955 which took her to nine Mediterranean countries in operations with the Sixth Fleet. Her air group of more than 80 planes participated in joint exercises with NATO countries under simulated battle conditions. Now in the shipyard at Portsmouth, Va., the *Randolph* will shortly return to the fleet with the new angled flight deck.



Capt. Jack C. Renard, USN
Commanding Officer

Commissioned in October 1944 the *Randolph* was the 11th *Essex*-class carrier built and the first to go into combat without returning to the builder after her shakedown cruise. After a postwar period in the mothball fleet the *Randolph* was converted for jet operations and returned to active duty.

In the latter part of 1955 the ship was awarded the Navy E for battle efficiency. Given annually to one ship in each class which has the highest battle efficiency score, the *Randolph* scored 89.47. This was the highest ever attained by an aircraft carrier.



HMR-363

Operational employment of Marine Helicopter Transport Squadron 363 during fiscal 1955 effectively tested its mettle, "on land and sea." Major commitments varied from an amphibious ship-shore trooplift during Operation Rainbow to a series of support missions in mountainous terrain. During another major operation, Desertrock VI, the squadron maintained 100 percent aircraft availability under extremely adverse conditions.

Lt. Col. K. M. Ford, USMC
Commanding Officer

In addition to its mission of troop support, HMR-363 is assigned the task of pilot training. During the year the squadron provided a transitional training syllabus for 50 student pilots.

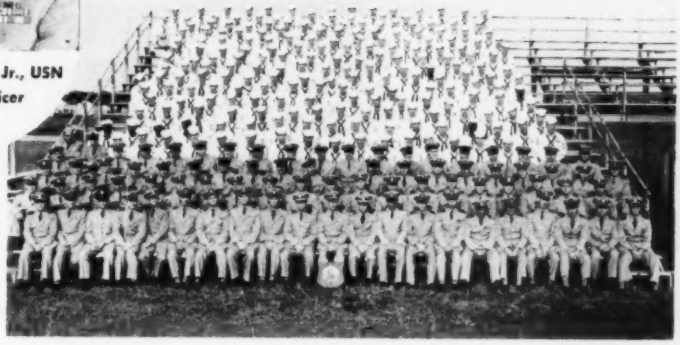
In strengthening the squadron safety program both the commanding officer and safety officer attended the aviation safety officers conference in October 1954. This conference was of value in providing the squadron with the tools to indoctrinate pilots and ground crews in the importance of aviation safety.

Through attendance at the regular monthly meetings of the Helicopter Pilot-Caused-Accident Committee the safety officer is able to keep his safety program up to date.

VP-5

The first of July 1954 found Patrol Squadron Five at Windsor Field in the Bahama Islands participating in anti-submarine development exercises. Later in the month a three-plane detachment was assigned to the Azores. It joined another detachment in an antisubmarine exercise in Key West.

Comdr. W. G. Matton, Jr., USN
Commanding Officer



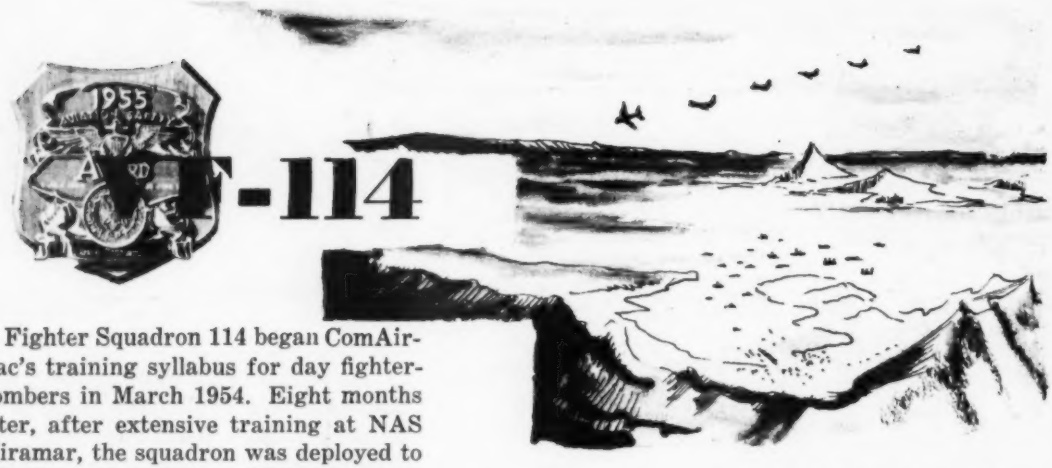
Lt. Comdr. M. D. Howard
Safety Officer

In September the squadron proceeded to Argentia for five months. Though its primary job is submarine hunting and killing, the search capabilities of the P2V aircraft are frequently employed for other missions. Ice reconnaissance patrols were flown as far north as Thule. Twice during VP-5's tour in Argentia the squadron joined intense search and rescue efforts in attempts to find missing transport planes.

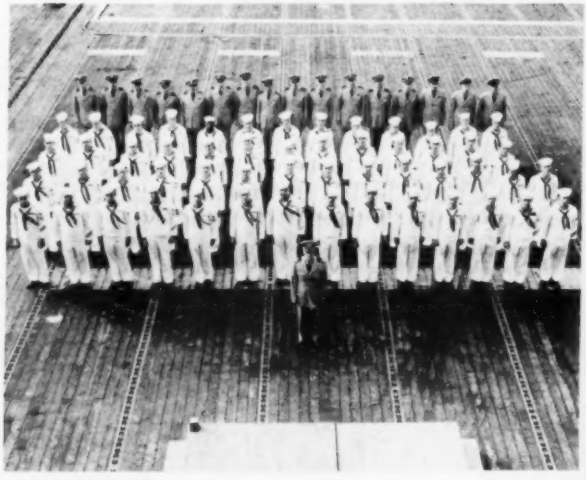
Participation in the Atlantic Fleet's operation NORAMEX won the squadron high praise from the operational forces and a "Well Done" from ComFAWLant. Of some 200 GCA approaches made in Argentia in January 1955 more than 60 were by VP-5 aircraft.

In late February the squadron returned to its home field at Jacksonville and shortly thereafter was assigned a lengthy development mission which required considerable flying from Caribbean fields.

VF-114



Fighter Squadron 114 began ComAirPac's training syllabus for day fighter-bombers in March 1954. Eight months later, after extensive training at NAS Miramar, the squadron was deployed to WestPac aboard the USS *Kearsage*. During operations in the Hawaiian area they helped CAG 11 earn the mark of "Excellent" which was assigned during an ORI. While in the Far East VF-114 participated in the Nationalist Chinese evacuation of the Tachen Islands.



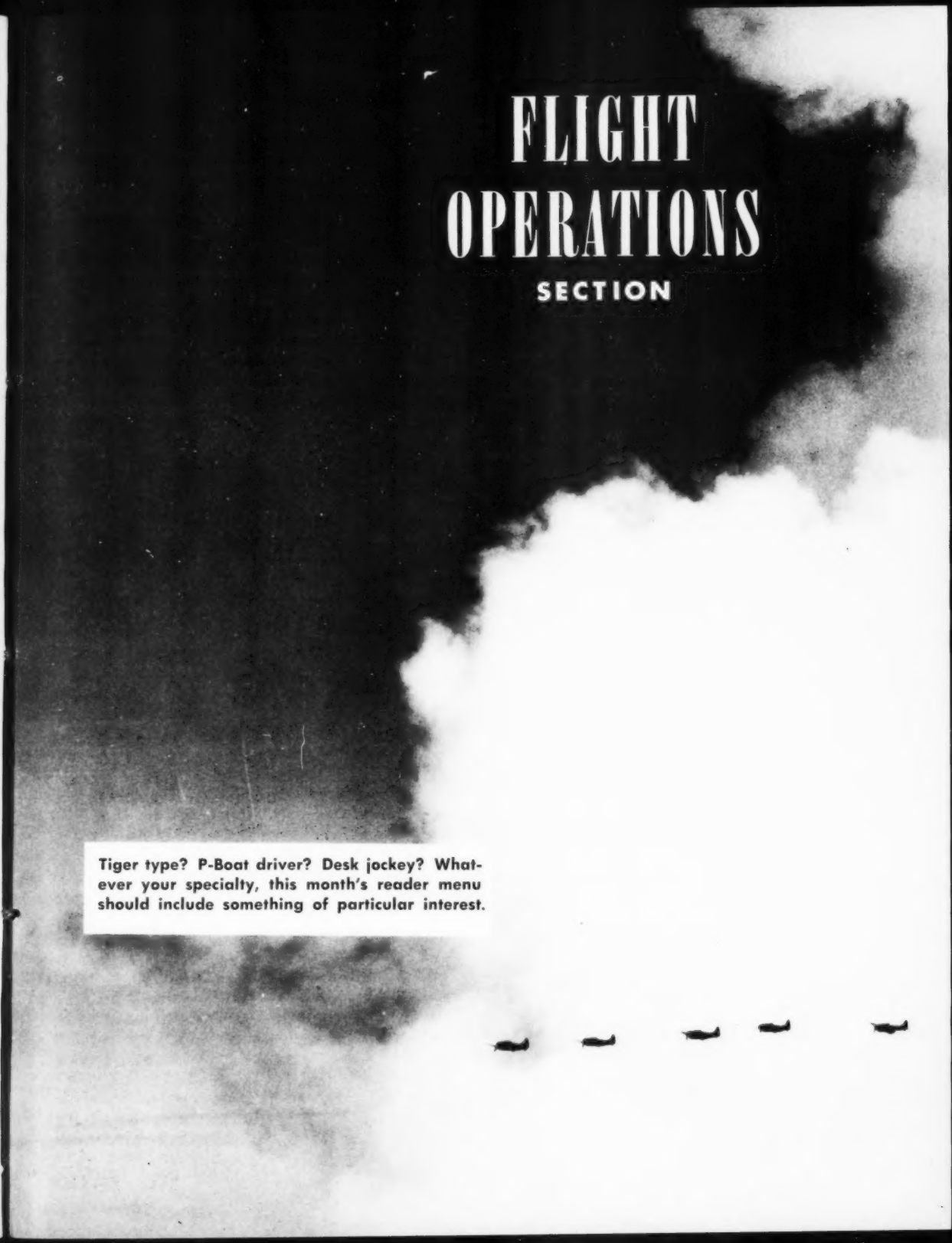
Comdr. G. F. Maxwell, USN
Commanding Officer

Upon joining WestPac units the *Kearsage* and its air group began a heavy schedule of training and operational missions. Most of this employment was in the Philippine area but in December of 1954 VF-114 was based ashore at NAS Atsugi, Japan for a short period.

The marginal weather encountered during this training was subsequently of great value when the squadron was assigned to the Tachen Islands evacuation off the coast of China. Having flown an intensive schedule of weapons training prior to the commencement of the operation, VF-114 was combat-ready in every respect.

The squadron returned to San Diego for re-forming in May 1955. It had flown 1300 hours and made nearly 1200 CV landings without an accident during the cruise.

FLIGHT OPERATIONS SECTION



Tiger type? P-Boat driver? Desk jockey? Whatever your specialty, this month's reader menu should include something of particular interest.

YE OLDE SONIC WALLE

"ONCE UPON a time there was a dragon who lived near a place called 'Ye Olde Sonic Walle.' Now this was a very ferocious dragon and he angrily set upon any knights who chanced to ride near his domain. His wrath was great indeed, and he put fear into the knights' steeds, causing them to behave strangely, and shook everyone up in general."

Undoubtedly, the above paragraph could be continued into a modern fairy tale with a happy ending as "Ye Olde Sonic Walle" is torn down and the ferocious dragon is slain, but the purpose of this article is not to tell an amusing story. Ten years ago the story was not at all amusing. Pilots flying World War II fighters at high speeds were discovering peculiar problems in control. Some aircraft wanted to tuck under and head for the barn, others reared up and refused to go faster, a few rolled uncontrollably. Trim tabs lost their effectiveness and control forces became so high the stick was almost frozen in the center of the cockpit. Aircraft and pilots were lost in trying

PROBLEMS AND TECHNIQUES OF TRANSONIC FLIGHT

By
William J. Cochran
Engineering Service Pilot
Grumman Aircraft Engineering Corporation

to learn something about high speed flight. A popular British movie showed a pilot pushing forward on the control stick to recover from a high speed dive.

All told, a barrier seemed to exist which prohibited controlled flight at speeds approaching the speed of sound and the terms "sound barrier" and "sonic wall" came into popular usage. There was strong doubt in some quarters as to whether it would ever be possible to fly an airplane faster than the sound it was making. Those with imagination visualized pilots flying at supersonic speeds in an eerie silence as they outdistanced the noise they were making. A story in a well-known weekly magazine developed the interesting thought that when a pilot passed through the sonic wall he became younger. (Actually, if he had aged it would have been closer to the truth). A few people acknowledged that it might be possible to penetrate the sonic wall with a needle-nosed aircraft, but worried about how you could slow down and back through the wall without wrinkling tail feathers.

Of course, some of the foregoing is ridiculous in light of what we know today and now we have reasonable, rational explanations of just what was going on and causing all the confusion. Perhaps the words reasonable and rational are unwise because you could take a year of postgraduate study on the subject at M.I.T. and work with equations that take up two pages and still not have a clear picture of the behavior of air near the speed of sound.

In the simplest of form, however, air is a compressible yielding medium at speeds up to the speed of sound, but becomes an incompressible, non-yielding medium more like a liquid at the speed of sound and faster. As an airplane flies along at a speed well below the speed of sound, air passing over and around it locally adjusts its speed so that after the airplane has passed, there will be no voids or vacuums in the atmosphere. This means that air passing over curved surfaces will have to speed up to meet air which is passing along flatter surfaces. (In speeding up, however,

(*Continued on next page*)

YE OLDE SONIC WALLE
(Continued)

the pressure decreases and in the case of a wing, lift results because of the uneven pressures above and below the wing).

Now as the airplane flies along at a speed close to but still less than the speed of sound—say 85 percent of the speed of sound or technically .85 mach number—air in passing over some of the curved surfaces may accelerate until it is moving at exactly the speed of sound. Trouble now develops because pressure variations further back on the surface cannot effect the flow up ahead because the signals are being sent forward at the same speed that the air is coming back. Because of this, a pressure disturbance called a shock wave develops.

Shock waves occur all over the aircraft wherever air is increasing or decreasing its speed through the speed of sound. Shock waves cause

William J. Cochran, Grumman engineering service pilot, is the author of "Ye Olde Sonic Walle." He has been with Grumman since 1948, and is currently a project pilot on the F11F. A naval aviator, he flew with the Marines from 1943 to 1947.

pressure discontinuities on the surfaces where they occur and these alter lift and drag and their distribution. Another effect of the shock wave is that the flow along the surface behind the shock wave is turbulent and trailing edge control surfaces which operate in this flow tend to lose their effectiveness. Practically speaking, the pilot feels changes in trim of the airplane, an increase in drag, sometimes a change in angle of attack, frequently buffeting, and a decrease in effectiveness of trailing edge control surfaces (tabs first, then elevators, ailerons and rudders). Because these phenomena occur all over the aircraft and sometimes not at exactly the same time on both sides of the airplane, the pilot experiences not only longitudinal (nose up and down) peculiarities, but also lateral (wing rolling) or directional (side to side) effects.

These phenomena do not all occur together but develop in sequence as the airplane speed increases. The first signs of these effects are usually noted between .75 and .85 mach number, the last by 1.0 to 1.05 mach number. The region between is called the transonic mach number range. Beyond the upper limit, supersonic flow exists over all surfaces of the airplane and the behavior of lift and drag are more conventional and pre-

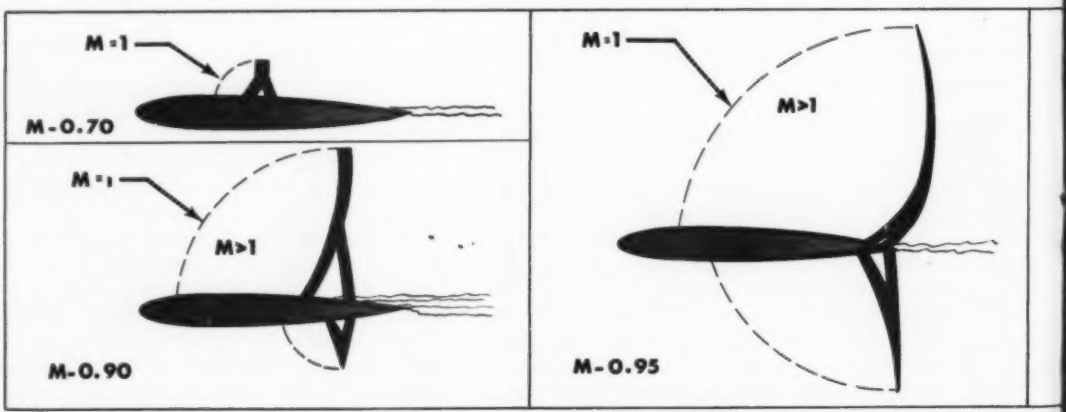


Fig. 1

Flow patterns for subsonic airfoils in transonic range. Dashed lines represent boundary between subsonic

dictable again. Figure 1 illustrates the shock wave patterns on an airfoil section at various speeds from .70 to 1.30 mach.

The nature and severity of these transonic control phenomena vary with each type of aircraft. Some, such as the F9F-2, may have a buffet and nose-up tendency around .83 mach number, which naturally prevents the airplane from going any faster. Others may have a control problem limitation such as severe wing dropping. A structural speed limitation for the airplane or its engine is not uncommon.

New models of Navy fighters, which are capable of supersonic speeds in level flight may have a speed and dive angle restriction intended only to insure the pilot enough room to pull out of a dive. The particular behavior, characteristics and limitations for each type aircraft are well covered in the Flight Characteristics section and the Vg diagram in the appropriate Pilots Handbook. All pilots

are strongly urged to know this material before setting out to explore the high mach characteristics of an unfamiliar airplane.

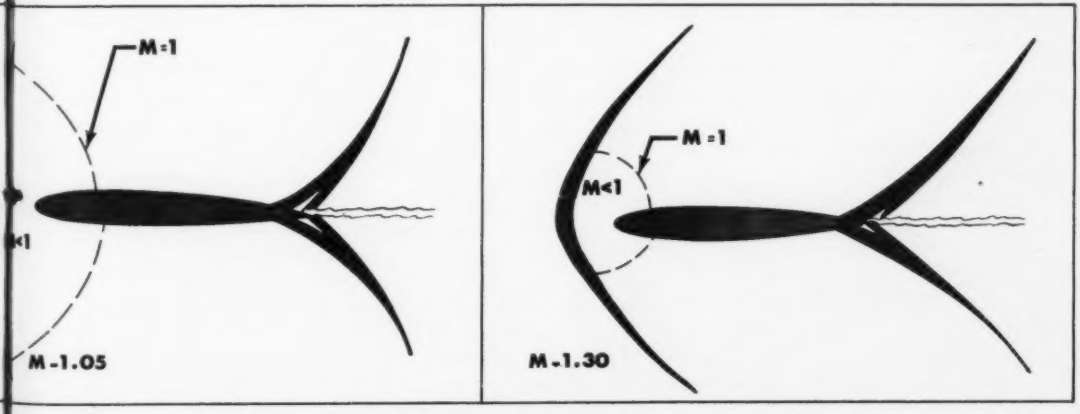
The remainder of this article is intended to supplement the material on high mach characteristics presented in the Pilots Handbooks with additional information, tips and suggestions which may prove helpful in making high speed flight more understandable, less mysterious and safer.

The biggest single suggestion is to be conservative and play it safe at first until you know what to expect.

Don't think you can read the book once, then climb to 45,000 feet, roll into a vertical dive and learn all about transonic flight in one easy lesson. It could turn out to be one lesson, period! Build up to high mach flight by starting out with shallow, short dives and then lead into longer, steeper dives as you gain experience. Compare high speed diving with learning to ski. Start out on the gentle slopes and build up to the all-out schussing.

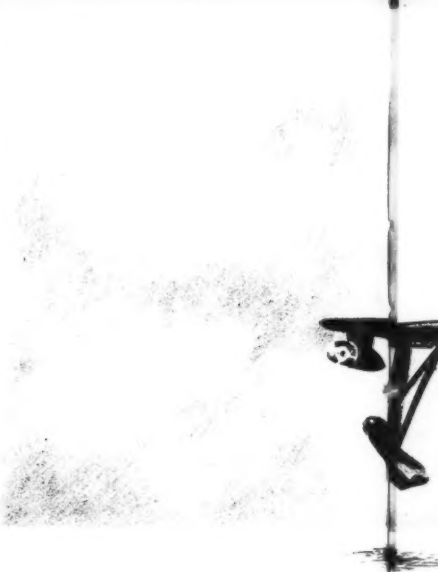
In doing high mach work, the effect of altitude is extremely important. Suppose we consider the F9F-8 as an example and look at how its terminal or maximum attainable mach number varies with altitude. Imagine that you take off in an F9F-8, climb as far above 40,000 feet as you have patience and then point the nose earthward (suit yourself on entry technique—

(Continued on page 45)



and supersonic regions, heavy lines indicate shocks, wavy lines, wakes and separated boundary layers.

SHORT STOP



Results of open sea landing tests conducted by Patrol Squadron 44 with P5M model aircraft have recently been made available to the Naval Aviation Safety Center. The VP-44 report is presented here as a supplement to a 1953 publication "Open Sea Seaplane Operations," dealing with open sea landing techniques for the PBM model aircraft. This report (NASA-A64-PL-953) published by the Aviation Safety Center, was based on tests conducted by the U.S. Coast Guard.

The *Approach* is appreciative of the initiative demonstrated by VP-44 in developing and reporting the recent P5M test to the Aviation Safety Center. Plaudits are also in order for the pilots involved, Lt. T. J. Guilday, and Lt. E. R. Moorman. Discussions of a similar nature are invited from other commands.

PRIOR to deployment for the open sea landings project, a careful review of the "Open Sea Seaplane Operations" report was made by VP-44 personnel. From this publication it was determined that there are three principal hazards of open sea landings: sea state, speed of impact and length of landing runout.

It is immediately seen that the first hazard cannot be controlled, and that the second hazard, the resultant of aircraft stalling speed as affected by wind and the movement of the sea, can be minimized by selecting a landing course in accordance with the above mentioned report. It is the third hazard, the landing runout, with which this discussion is primarily concerned.

General experience indicates that almost always the damage or break-up occurs during the runout after a safe and often easy initial touchdown has been accomplished. Therefore it would follow that if this runout could be shortened and if the aircraft could be kept from bouncing out of the water, there would be a minimum of damage inflicted. This is how VP-44 went about developing its technique to reduce this third hazard.

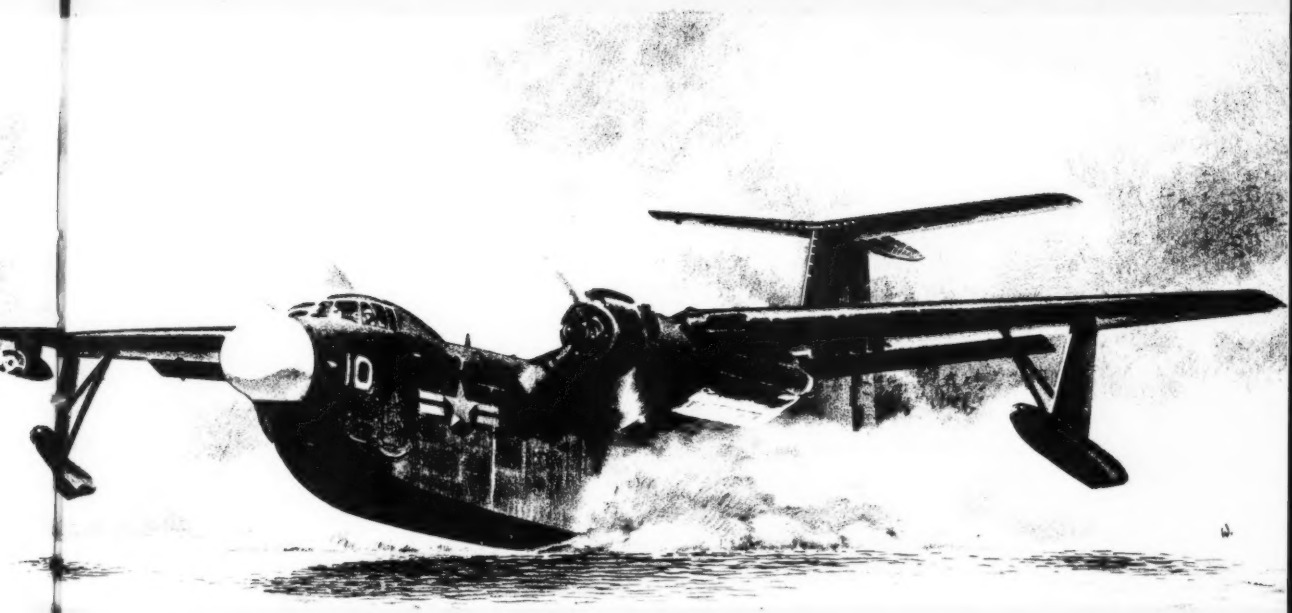
Pre-deployment Practice

Before leaving Norfolk for San Juan, 10 full-stall landings were executed in the following manner: The aircraft was flown at 2 or 3 knots above the stalling speed approximately 10 feet above the surface for one-half to three-fourths mile. This was to simulate waiting for the "right spot" in the open sea. The pilot then selected a buoy in the line of seadrome buoys and attempted to land directly opposite it. The throttles were abruptly closed and the nose held up until the plane stalled.

As soon as contact with the water was made the throttles were rapidly retarded to the reverse thrust position and 40" MAP in reverse was maintained until stopped. The average runout was estimated to have been 250-300 feet. The average time from touchdown to stop was approximately 10 seconds. All of these landings were made into a wind of about 10 knots. There was no noticeable change in trim and no tendency for the nose to buck upwards or to tuck under during the runout.

Test Conditions

After arrival in San Juan it was decided that landings would be made on 4 days in an area 8 miles north of San



Juan. Due to the nature of the project only 1 landing was made on each day. During each landing a 10-knot wind was blowing with the swell. Heights of the swell varied from a low of 4 feet on one day to a high of 8 feet on another. A confused chop or wave from 1 to 3 feet high was present in addition to the swell. The swells varied from 100 feet to 400 feet in length and moved at speeds of 15 to 25 knots during the 4-day period. The 4 landings were made parallel to the swell with a 10-knot 90-degree crosswind.

Reversed Props in Air

On these landings it was decided to use full power in reverse and to effect the stall by reversing the props *while still airborne*, thereby further decreasing the runout. As soon as the touchdown spot was selected the throttles were closed and immediately moved to 50" MAP in reverse.

It is realized that this exceeds the maximum reverse power recommended in the P5M Handbook (2530 rpm, 42" MAP) but it is maintained for such a short period (5-7 seconds) that the benefit of the reduced runout distance is considered greater than the chance of engine damage. Using this procedure the props were in reverse on each touchdown and on two occasions were developing considerable power prior to touchdown.

This use of reverse thrust did not effect the control of the aircraft in any way. Nose attitude did not change and there was no tendency for a wing to drop. Most important, the aircraft never left the water at any time after the touchdown, although both pilots are certain that several high and extremely serious bounces would have occurred during a normal runout. Runouts experienced during these landings were from 150 feet to 250 feet, and the time from impact to stop did not exceed 5 seconds.

The average weight during each landing was 61,500 lb. All of these landings were very easy or soft landings, more so than a normal stall landing in a choppy seadrome. The plane appears to ride over a swell or large wave in a very nose-high attitude and is then eased down very gently. Slamming or bucking was never experienced. This cushioning effect is believed due to the reverse thrust being applied well above the center of gravity in the already nose-high

(*Continued on next page*)

SHORT STOP (*Continued*)

stalled attitude.

Only one takeoff was made in the open sea. Since the purpose of the project was not a test of the P5M it was decided to taxi back to San Juan on three occasions rather than risk damaging the aircraft. It was during these long open sea taxi periods that the aircraft was given the name USS *Tidalwave*.

Single Engine Tests

Most open sea landings will only have to be made as a result of an emergency flight condition and most probably with only one engine operating. In view of this, a limited amount of testing has been accomplished simulating this condition.

The aircraft was taxied at 70 knots, both throttles quickly closed and one retarded to 42" MAP in reverse. As the reverse power was applied the opposite hydroflap was extended. Due to the speed through the water the hydroflap could not open very far against the water pressure and a slow swerve into the reversed engine commenced.

This was not violent and the wings were held level with the ailerons. Before the aircraft had swerved 20 degrees it had slowed sufficiently for the hydroflap to open enough to become effective and the swerve was countered. The runout was controllable until just prior to stopping.

At one point the aircraft was slow enough that the fully extended hydroflap could no longer counter the swerve due to the reverse power. Reverse power was immediately reduced, and the extended hydroflap then caused a sharp turn and threw the outboard wingtip float down hard. This occurs at such a slow speed that danger of damage is remote and if the runout were experienced 2 or 3 times the swerving could probably be eliminated. The runout distance from 70 knots to stop was approximately 450 feet and took approximately 12 seconds.

It is not known whether or not one engine in reverse would prevent a bounce during an open sea runout. A bounce in this condition will certainly result in a violent swerve which could be more disastrous than a normal runout.

Good in Almost Any Sea

Although the experience gained is very limited it is nevertheless concluded that the P5M can be safely landed without break-up or injury to personnel in almost any sea condition. This procedure is recommended if the pilot has the use of both engines. It should be possible to find relatively calm stretches of water 300 feet in length that would conform to the recommendations for best landing courses in almost any sea.

The decision to use reverse power during a single-engine open sea landing will have to be made on the spot and will depend primarily on just how rough the surface is. Its use will reduce the runout distance by at least a third and possibly one-half but the pilot must be extremely alert to reduce all reverse thrust during any appreciable bounce. This procedure is therefore not always recommended.

NATC COMMENT

Requested to comment on the technique presented in this article, NATC Patuxent River indicated a general approval of the open sea landing procedures for the P5M, but cautioned pilots that: the technique employed requires much practice before attaining proficiency; that very reliable reverse pitch operation of the propellers is required, and that use of reverse pitch on *single-engine* landings can be extremely hazardous.

Additional comment obtained from experienced PPCs includes the following considerations of importance to *Marlin* pilots: The suggested technique appears very desirable under conditions where ditching is necessary in daylight and when both engines are operating; the technique would be undesirable on single engine until after contact with the water, and then only at partial power; at night it may or may not be desirable depending on the use of landing lights and the ability of the pilot to judge distance above water and swell direction.

In such a situation the technique would be recommended after touchdown. Bearing in mind these considerations, the procedure is recommended for an emergency landing, with the key to employment of the technique being, as always, subject to pilot discretion.

A final note of concern was offered by maintenance personnel who consider it undesirable to practice this technique because of the wear and tear on the engine. ●

DRAG

Primer for Pilots—No. 5

This is the fifth in a series of articles to acquaint the average naval aviator with a few of the basic principles of aerodynamics applicable to present day high performance aircraft. Comments received to date in response to these articles have varied all the way from "Bravo! Encore!" to a gruff "Over-simplified—Technically inaccurate." In between these two extremes we have heard "too breezy" and "just right." Herewith an article devoid of breeziness but in the interests of simplification, admittedly technically inaccurate from the point of view of the professor. Your comments are solicited.

THIS article discusses the principles of the "Drag Curve" as it applies to both propeller-driven and jet-propelled aircraft.

These basic fundamentals can be used to good advantage in the situation where a jet aircraft is undershooting a runway, or in the situation where a multi-engined aircraft is proceeding to an airport with one or more engines out. (It is also applicable in all portions of the FCLP or carrier landing pattern.)

The "Drag Curve" classically represents indicated airspeed plotted against *thrust* in the case of a *jet*, and indicated airspeed plotted against *horsepower* for propeller-driven aircraft. For purposes of simplification, this article will depart from the classical presentation and discuss this curve on the basis of indicated airspeed versus *power setting*.

Throughout this article, "power setting" will be used as the generic term for thrust, thrust horsepower, brake horsepower, or propeller thrust. This brash treatment of an exact and precise representation of data is given in the interests of simplification and expediency.

Drag

When an engineer speaks of drag acting on an aircraft, he is speaking of total drag which is a combination of induced drag (drag incurred by the wing producing lift) and parasite drag (drag which is always present due to the wind resistance of the frontal area of such things as windshields, rivet heads, skin friction around the fuselage, and the equivalent flat-plate area of the complete aircraft; i.e., "barn door" drag).

In the primary design stages of any aircraft, induced drag and parasite drag are carefully computed for various speeds throughout the speed range of the aircraft. These two values are then added together and a plot is made of

(*Continued on next page*)

DRAG *(Continued)*

the total drag versus the indicated airspeed. This is labeled the "drag curve" and becomes the basis for selecting a suitable power plant.

The Drag Curve

Drag curves for all models and types of aircraft have the same characteristic shape. The speed ranges plotted on the horizontal axis of the curve may differ and the units used to measure the power setting required to handle this drag on the vertical axis may vary, but they all have these fundamentals in common: (a) Near the stalling speed a high power setting is required; (b) at maximum speed maximum available power setting is required; and (c) in between these two points there is a speed where a relatively low power setting will keep the aircraft in straight and level flight.

Figure 1 shows the characteristic shape of a drag curve. Points A, B, and C are: (a) the power setting required near the stalling speed, (b) the minimum power setting which will maintain straight and level flight, and (c) the power setting required for maximum indicated airspeed, respectively.

Note the legend for this curve which is entered in the box in the upper left-hand corner of the curve. This specifies that the curve represents the total drag acting on the aircraft at a specific altitude, a specific gross weight of the aircraft, and a specific air density ratio. It further specifies that the aircraft is in straight and level flight, neither gaining nor losing altitude nor turning in any direction. This last is to insure that exactly one G is acting upon the aircraft when the data are taken to draw this curve.

Induced *vs* Parasite Drag

This curve or graph type of presentation is identical to the procedure geographers use to locate a position on a nautical chart. (See page 14 of the July 1955 *Approach*.) This means that for any given airspeed you can run a vertical line upward from the airspeed selected, and where this vertical line intersects the curve you will locate a point. A horizontal line drawn from this point to the left-hand scale of our graph will intersect the left-hand scale

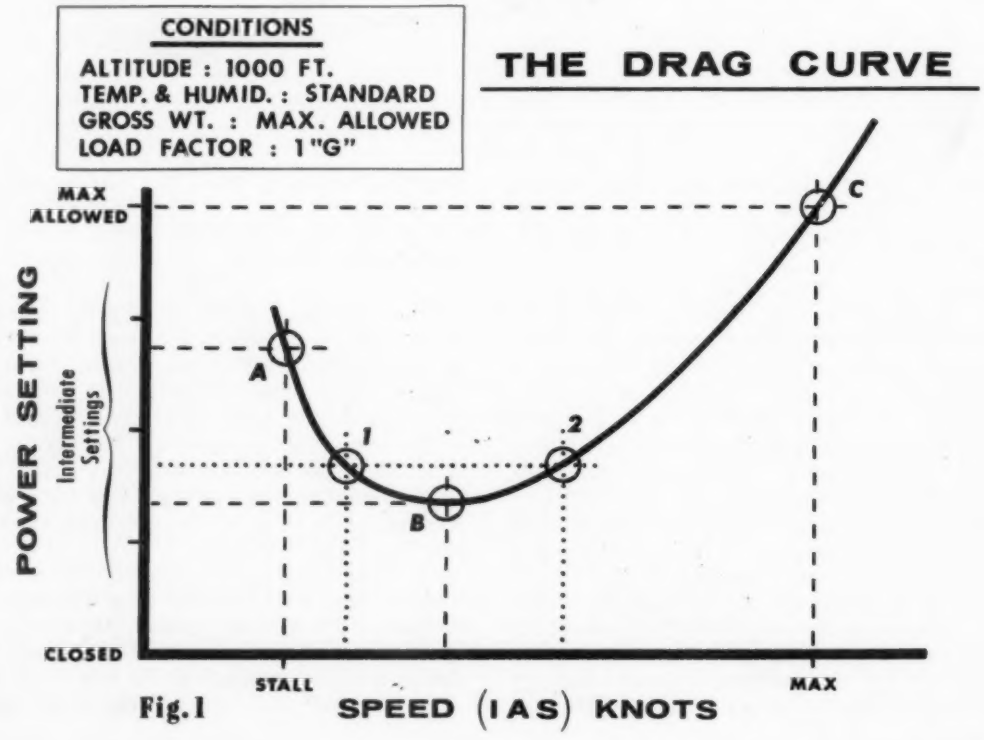


Fig. 1

at the power setting required for that speed.

In drawing a drag curve, flight tests are made to establish a series of points. Each point represents an indicated airspeed and the power setting required to maintain that airspeed. When a representative number of points have been established by flight tests, they are plotted individually and then joined by a smooth curve. For any aircraft, this test curve has the same general shape as the one shown in Figure 1.

Two Key Factors

An examination of Figure 1 will show several interesting factors. First, point B indicates an airspeed and a power setting which is the minimum setting that can be used to maintain the conditions specified in the legend in the box. It should be obvious that this is the airspeed to be flown for maximum endurance at the specified altitude.

Another interesting situation can be disclosed by choosing at random an airspeed somewhere between point A and point B, and noting the power setting required to maintain this airspeed. Once again it should be obvious that with this same power setting applied, the aircraft will also maintain an indicated airspeed in excess of that required for point B.

The technique required to place the aircraft at either of these two speeds will not be discussed herein; however, one of the basic fundamentals to be obtained from this article is demonstrated in this consideration. Namely, in the medium speed ranges of any aircraft there are two airspeeds at which the aircraft will maintain straight and level flight, using the identical power setting in each case (example: points 1 and 2 on Figure 1).

In the old days we called the slower of these two conditions "hanging on the prop or mushing" and the higher speed "on the step." This consideration is known by most naval aviators intuitively or through experience or otherwise, but the *reasons* for it are not so widely known. The basic reason, of course, is the fundamental shape of the drag curve. This fundamental shape in turn is the result of the inherent properties of induced and parasite drag.

Using the Drag Curve

Induced drag reaches a maximum value at the stalling speed of an aircraft. Usually it is at least 75 percent of the total drag at this point. As the speed of the aircraft is increased from the stall speed to the maximum speed, induced drag becomes less and less. *In some of our present-day high performance aircraft the induced drag at the maximum speed is less than 10 percent of the total drag.*

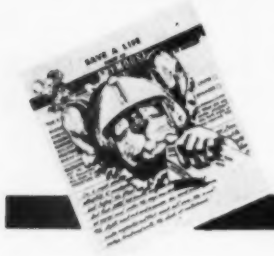
Parasite drag, on the other hand, operates exactly opposite to this. At stalling speed parasite drag is at the lowest value it can reach while the aircraft is in flight. As the airspeed is increased from stalling speed to maximum speed, parasite drag increases sharply (as the square of the speed) so that at maximum speed it represents approximately 90 percent of the total drag which must be overcome by the power plant to maintain flight at this speed.

Both of these curves (induced and parasite drag) can be plotted using a power setting for the vertical axis and indicated airspeed for the horizontal axis, and it will be seen that the two curves intersect at the precise speed where we find the minimum required power setting. Using the simplest of arithmetic, these two curves can be added and the total resultant curve drawn. This is the curve which we show in Figure 1.

In summarization it can be stated that: *Induced drag predominates in the lower speed ranges; parasite drag predominates in the higher speed ranges.* These two facts explain the reason for the characteristic form of the drag curve.

★★★

Editor's Note—The next article will discuss that condition of flight known as "operating in the region of reverse command." Fundamentals discussed here will be used freely. If you have questions concerning the drag curve and our presentation here, we suggest you get some assistance from any graduate of the Aviation Safety Officer Course at USC, any TPT graduate, or any Post-Graduate Aeronautical Engineer. (Or refer to "Airplane Aerodynamics," pages 233, 242 and 249. This book is in many Navy libraries. It was written by Dommasch, Sherby and Connolly, and published by Pitman Aeronautical Publications.) Without firm understanding of this article, you will not get the most out of a forthcoming article in the February issue.



ANYMOUSE and

FILTER ELEMENTS

"Immediately after takeoff and as I reached over to pull up the gear handle on my F9F-2 I noticed a tendency for the plane to go into a left turn. After retracting gear and flaps at 150 knots the plane went into a left roll. I took my left hand from the stick and tried to inform the tower of the ususual situation but by this time the bank was approximately 60 degrees at a very low altitude (above house tops)."

Anymouse tried to turn off his aileron boost but it required both hands on the stick to attempt to keep the left wing up.

"How, I'll never know," said Anymouse, "but I put my right leg over the stick and used the back of my knee to force the stick to neutral. I shut off aileron boost, called the tower and made a right-hand pattern to a safe but shaky landing." Anymouse reported that he had thoroughly checked the plane prior to takeoff.

A bench test of the aileron boost by O & R found that: (a) the piston moved faster to the left-hand position than to the right, (b) the internal bypass was five gallons per minute with maximum permissible 2.5 gpm, (c) the lever clearance was zero, should have been .040 inches, (d) a quantity of brown colored plastic-like particles was in the left-hand side of the cylinder (these particles looked like the adhesive used in the assembly of micronic filter elements.), (e) the hydraulic fluid was analyzed and found to be 80 percent hydrolube.

CLEAR FOR EMERGENCY

Anymouse feels that all aviation activities including CAA towers, military towers and local civilian radar facilities are guilty of "unwarranted and indiscriminate use of 121.5 mcs for information and traffic that is not of an emergency nature." "This, if continued, will keep the channel blocked when needed for an actual emergency. I have found this occurring all over the United States."

CLOSE CALL

After the usual briefing Anymouse and his wingman took off on a scheduled type instrument hop in F2H-3s. As soon as they were airborne Anymouse switched to the tactical frequency and called his wingman for a radio check.

Anymouse said, "He didn't answer my call but did make several hand signals among which was a thumbs-up.

"This was the first time I had ever flown with this particular pilot and I thought he was Rogering my transmission with a hand signal.

"At about 3500 feet I pulled the instrument hood over my head. I was about 30 knots slow for my climb schedule so I lowered my nose to pick up the needed speed. As I did, I scanned as usual, and used the gyro-horizon (Model H-5) to pull my nose back through the horizon. I noticed that the gyro indicated a right bank. Accordingly, I made a correction to the left. My altimeter continued to unwind. I increased my back pressure and made an additional effort to stop the increasing right bank as shown on the gyro.

"At this time I called my wingman to make sure I wasn't in any danger. He didn't answer immediately so I popped the hood and recovered from a 40-degree left bank at approximately 1500 feet.

"My first mistake was not getting a positive radio check. My wingman tried to call me repeatedly, but because my radio was not correctly switching channels, I was unable to hear him. The second and biggest *faux pas* was not checking the integrity of my instruments in actual flight conditions prior to going under the bag."

...d his hairy tales

Anymouse reports are submitted by Naval and Marine Corps aviation personnel who have had hairy or unsafe flight experiences. As the name indicates these reports need not be signed. The purpose of Anymouse Reports is to help prevent or overcome dangerous situations. Forms for writing Anymouse Reports are available in ready rooms and line shacks. All reports are considered for appropriate action. Send reports to the Naval Aviation Safety Center, NAS, Norfolk 11, Va.

WHEW!

On three occasions the P2V-5 was written up for strong fuel fumes in the radio compartment during climbs. Some 100 gallons of fuel were being carried in the bomb-bay tank and it was believed the fumes were originating in the aft part of the bomb bay.

On the fourth flight the fumes again became evident and were traced to the aft decking plates of the radio compartment.

While at 10,000 feet Anymouse, the flight engineer, volunteered to enter the bomb bay and try to find the leak. The pilot agreed not to open the bomb-bay doors until Anymouse reported that he was back on the flight deck.

Due to the close quarters Anymouse was unable to wear a chute. He entered the bomb bay and reached the aft end, checking all fuel lines and fittings. While holding onto the bomb-bay door drive torque tube he heard an electro-hydraulic motor start to run. The torque tube he was holding began to turn. At that point he grabbed for the main fuel line to the starboard tank and the bomb-bay doors began to open.

The doors remained open for about 15 to 20 seconds and as they started to close Anymouse lifted his legs up above the doors until they were closed. The copilot then peered into the forward end of the bomb bay and asked if he was all right. Anymouse said "yes" but added, "I would rather remain in the bomb bay until after we land."

After landing Anymouse found that the pilot had forgotten he was in the bomb bay and had commenced a let-down, opening the doors to decrease the air speed and vent the fumes in the after compartment. The copilot had reminded the pilot and the doors were immediately closed.

In analyzing this near-accident the pilot and Anymouse both agreed that no one should enter the bomb bay in flight. If it were necessary to remove a hung bomb, the appropriate circuit breakers should be pulled to preclude an inadvertent opening of the doors.

THAT'LL LARN YA!

"While practicing takeoffs and landings in a P2V the pilot under instruction would pull the aircraft off the deck rather than let it fly off. As soon as he was airborne he would raise the gear. I explained the trouble he might get into from this procedure, in case he lost an engine before getting single engine speed, and decided to impress the point on him.

"He again pulled the plane off at about 100-105 knots and raised his gear about 110-115 knots. At this point, at an altitude of about 50-100 feet, I cut the starboard engine. The student didn't do anything for two or three seconds and when he was in doubt that he could make it, he cut the other engine!

"There we were at about 75 feet, gear coming up, both engines cut with about 115 knots airspeed. At this time I put everything full forward, took the plane away from the student and made it. But it was close." ●

Weather and power plant trouble resulted in a salty ending for this flight.

Truth and C

A DIGEST O CEN

VP P2V-5

TROUBLES COMPOUNDED—Deteriorating weather and severe turbulence at a Caribbean air station forced pilots of a P2V–5 to abandon a range approach and proceed to an alternate. The pilot had not previously landed at that alternate and the range plate was not aboard.

Due to a combination of poor weather, erratic pressure instruments on the pilot's side, and a rough running starboard engine, the pilot attempted to remain VFR. Thirty minutes from landfall low clouds and rain showers were encountered and the pilot was forced down to 200 feet to remain VFR.

Breaking into a clear area, climb power was applied and at that point the copilot reported fire in the starboard engine. Engine instruments gave no indication of fire and the copilot was directed to look again. The pilot received an affirmative reply and immediately feathered the engine. Altitude could not be gained and the airspeed remained at 120 knots.

A visual inspection of the port engine showed it to be running rough, emitting puffs of white smoke. BMEP was down to 190 from a normal reading of 218. Shortly after landfall it dropped to 170.

Locating the airport by its rotating beacon an approach was set up. Turning onto final the pilot saw he would have to use excessive bank to line up with the runway, and so considering his altitude and engine conditions, discontinued the approach to that runway.

The pilot felt that the port engine might quit at any time and he elected to make a landing on the next available runway, even though it would be downwind. On final, both pilots noticed what appeared to be a high bluff on the approach end. Full flaps were used to balloon the plane over the obstacle and touchdown was made about 1500 feet down the runway at 110 knots.

There was deep water at the end of the runway and the pilot believed he could not stop on the remaining 3800 feet. He decided to swerve into a muddy shoulder area. Brief use of reverse thrust caused the plane to leave the runway at about a six-degree angle. Nosewheel steering was ineffective in turning the plane parallel to the runway. It continued to the left and went over a low seawall into water for strike damage. There were no personnel injuries.

Analysis by the accident board indicated that the pilot feathered his starboard engine without further verification from other crewmembers. It was noted the copilot had erroneously reported an engine fire one week previously. Also, the copilot was an experienced lighter-than-air pilot but had only 290 hours in HTA aircraft. The navigator aboard was a qualified PP2P and had 400 hours pilot time in the P2V. The board strongly recommended that the best qualified copilot be in the cockpit under adverse conditions.

It was felt that the decision to swerve off the runway was premature. At the point of impact the speed was estimated at about 50 to 60 knots. The board believed that full braking could have stopped the plane on the remaining 2155 feet if it had stayed on the runway.

Other recommendations included: (a) single-engine landing procedures be continuously stressed, (b) familiarization flights to all fields which may be used as alternates, (c) publications and equipment be thoroughly checked for completeness befor each flight.

nd Consequences

EST RECENT AIRCRAFT ACCIDENTS

VR R6D

JUMP SEAT CONFUSION—During takeoff in an R6D the co-pilot called V1 speed to the pilot. Thinking he heard the command "gear up," the flight engineer in the jump seat position raised the gear handle to the UP position, then seeing the plane was not airborne, returned it to the DOWN position. Damage occurred when the nosewheel partially retracted allowing the inboard propellers to contact the runway. Throttles were retarded and the yoke hauled back which allowed the nosewheel to lock down again.

Contributing factors included an improperly installed locking pin which allowed the gear lever to actuate the system before the aircraft was airborne.

It was recommended that only qualified pilots be allowed to perform jump seat duties on all flights and when only two pilots are assigned to a flight that complete understanding be reached as to who will accomplish the various jump seat duties *prior to takeoff and landing*. Also that the individual charged with raising the landing gear and flaps be required to repeat the order from the pilot before performing the movement.

ZP ZP-3K

EVEN ZP NEEDS FCLP — Wind and sea state was considered normal and four carrier landings had been made by the ZP–3K. Control of the elevator was then turned over to a pilot who had no FCLP or previous carrier landing experience in the elevator position.

He was fast on his first approach and was waved off. The second approach was a Roger pass until the airship was about 75 yards astern of the carrier. At that point the pilot believed himself to be high and reduced power and lowered the nose approximately three degrees.

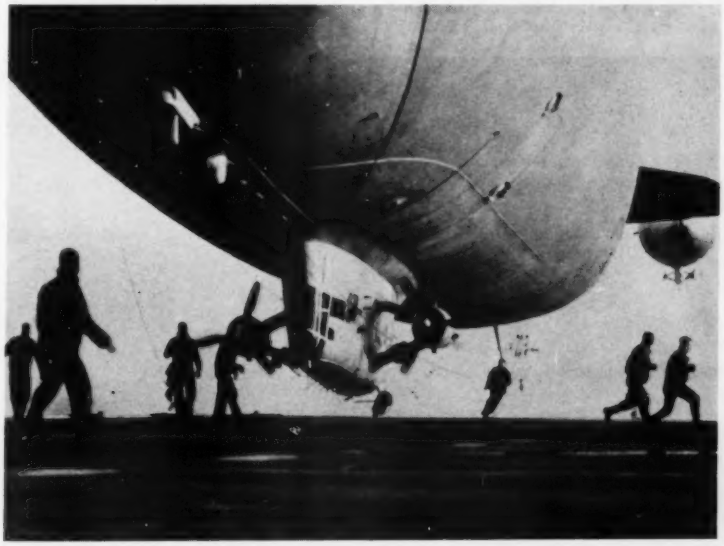
The airship began to settle rapidly and the LSO gave an exaggerated low signal. As the control car was below the flight deck level a wave-off would possibly have caused the car to hit the ramp.

Power was increased and full up elevator applied, but the airship did not recover sufficient altitude in time to prevent the landing gear from striking the ramp. The gear sheared and its aft movement damaged the radar gear.

Both the accident board and reviewing authorities stressed the value of the LSO in contributing to a safe carrier landing. Just as in heavier-than-an-aircraft emphasis on FCLP was recommended as a measure to improve pilot alertness in obeying and answering LSO signals.

(*Continued on page 26*)

It was a Roger pass until the pilot controlling the elevators dropped the nose.



TAILHOOK RODEO

THE pilot gent from the tall-in-the-saddle country squinted up from his readyroom seat.

"Carrier landings?" he drawled, "Simple as ridin' a hoss."

"Not that ever'body can straddle a hoss proper," he added, "Some of these here carrier cowboys put me in mind of bronc-bustin' day at the rodeo.

"Man," he chuckled softly, "we got 'em all. Real savvy wranglers, and fence busters; top-hands and flashy aviator artists, and mebbe once in a while a greenhorn who ain't learned to hold the reins on these monoplane mustangs.

"Why, somedays, a'sitting up there on buzzards row, it's just like watching the finals at Pendleton or Calgary. For example, there's the jet jockeys that come a' galloping up to the LSO like they was bringing a jumper up to the fence — and sometimes they go right on to try hurdling the barriers too.

"One feller I know brings his Able Dog up the groove like a five-gaited Palomino. 'Pears like he's not quite sure whether it's him or the airplane got the bit in his mouth. That's when the ol' LSO works like a woman hanging out clothes on a windy day.

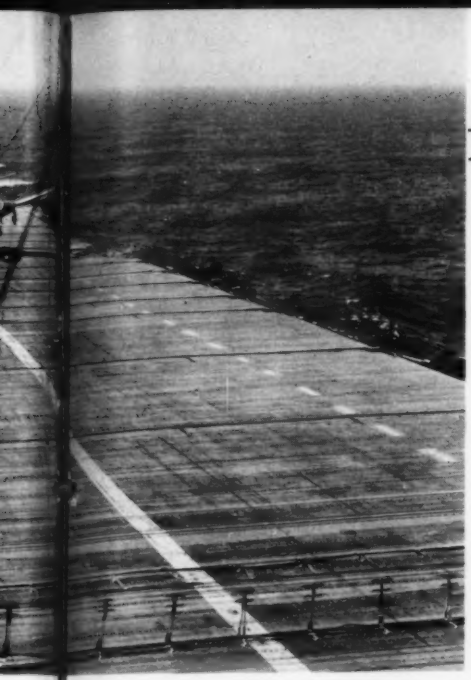
"Another one of these pilgrims will kinda worry his airplane up the trail like the flight deck was gonna slide right out from under him—sort of spooky, you might say.

"Then there's the tailhook dude who sashays around the pattern and frisks up to the ramp without paying attention to the signals. Does

Watch her, podnuh, she's headed for the barn!

Get her head up, son, she's got the bit in her t

Hold her Newt, she's a'rarin'!



tol'able well most of the time—but can't never understand howcome he gits waved off so much.

plane's rump, the way they kick up their tails. Man, they get the bit in their teeth, stick their heads between their legs and purely stomp all over the place. Then they sorta bow in the middle and buck up the deck like they was aimin' to stampede plumb over the fence.

"If the man in the saddle relaxes in the stirrups, some of these aircraft critters just seem to act plain ornery, stretching out their necks and loping stiff-legged up the deck. They come a'charging up to the barrier, rearin' and a'tearin' with the cowboy in the cockpit grabbin' for all the leather he can find to slow the animal down.

"Course these landing fandangos by the propeller pintos and the smokepipe stallions

Ride 'em cowpoke!

"And to watch some of the goings-on after the cut signal—why, son, you'd think sometimes that the LSO had laid a quirt across the air-

give a sort of bad name to an otherwise well-broke herd of thoroughbred stock. I count it a shame we can't remember the way most of these wind-

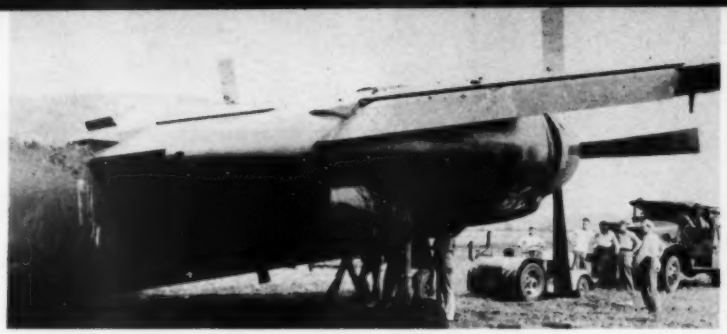
machine wranglers bring animals up the groove under the kind of firm touch that makes the airplane like to be bossed.

"Yessir," the horseman-turned-pilot stretched to cross his legs over the next seat,

Don't fence me in!

"flying these contraptions around a carrier is like herding steers with a good quarter-hoss cutting pony. You got a man-sized job, but you got the best they is to do it with—the rest is up to you. Any saddle traveler can tell you a hoss is mighty apt to get unruly if you don't keep a mindful curb, but just you keep thinking one step ahead of the critter and you'll never get throwed."

He cocked a knowing eye. "Might say that's the whole point in this business." ●



Shortly after touchdown the pilot found his brakes had stopped working.

VAH AJ

HOT AND LO-O-O-NG—Upon completing an eight-hour practice night bombing mission in an AJ-2, the bombardier-copilot received permission from the plane commander to make the daylight landing. The tower reported that the wind was calm.

Though the copilot had a total of 73 landings in 18 months, he had only one landing and three hours pilot time in the preceding three months and 11 landings in six months.

The first pass was high and fast and the pilot took a voluntary wave-off. Flaps were bled up to the halfway position. Upon re-entering the pattern the tower advised that a tow banner was being prepared on the approach end of the runway and requested the aircraft to land at least past the first taxiway intersection (500 feet from the approach end).

The pilot Rogered this request but became confused and believed the tower had meant the second taxiway down the runway (nearly 3000 feet from the approach end).

Though the flap handle was again positioned for full flaps, neither pilot checked the flap indicator. The pilot did note the absence of a customary ballooning effect. Brakes were not checked on this approach.

Power was reduced considerably when the pilot felt the speed was higher than normal. In spite of this the airplane sailed over the fence at 125 knots and touched down 3700 feet from the approach end with only 3300 feet of runway remaining. Touchdown speed was 20 knots higher than recommended by the handbook.

When brakes were applied it was realized that the normal system was out. Emergency brake was used and subsequently the wheels locked. With tires blown and wheels locked, the aircraft slid 50 yards into a muddy overrun.

During the investigation it was found that loss of hydraulic pressure occurred during the wave-off, after the flaps were bled up. This resulted in the flaps being frozen in the mid position and accounted for the lack of normal braking.

The accident board concluded in part, that pilot fatigue was a minor contributory cause but recommended that pilots be mindful of the hazards associated with pilot fatigue, and that particular vigilance be exercised during the final portions of a long flight. The flight surgeon noted that neither pilot had slept for 24 hours, no food had been carried aboard the plane, and the last three hours of the flight had been without oxygen at a cabin pressure of 10,000 feet.

VA AD

ROCKET HANDLING — Upon triggering his seventh 2.25 inch rocket (SCAR) the pilot of an AD felt it explode under the port wing. After recovery he had another AD pilot make a visual inspection of the damage. Though damage appeared superficial, the outer wing panel required replacement.

In a similar case, a P2V was on a rocket run and when the release button was pressed a rocket under the port wing exploded. Oil began flowing from the port engine. It was secured along with all electrical circuits and a single-engine landing was made without incident.

Investigation in both accidents attributed the explosions to defective rockets for undetermined reasons. The rocket propellant may be broken under rough handling, permitting it to rotate and block the ports which permit the burning gasses to escape. In such cases an explosion will result.

It was recommended that whenever a rocket is known to have been mishandled, dropped or roughly handled, that it be immediately surveyed.

While it's mighty satisfying to light one up during the hustle of briefing, or the letdown after a hop, you'll also find it to your advantage to know some of the effects of cigarettes on you as an aviator. They're discussed in "Let Up on the Light Up," beginning on the next page.

'Let Up on the Light Up'....

TO irritate your eyes, impair your flight vision and depth perception, and reduce your altitude tolerance, take small doses of carbon monoxide. How? It's easy—just smoke! The serious effects on your system increase with dosage.

Approach

. . . . says Dr. Zip Suture, spokesman for Navy flight surgeons. He also adds that "you'll be amazed at the conclusive documentary evidence revealed here about the weed and you."

Unfortunately most pilots do not recognize that tobacco acts in a way similar to alcohol, as far as vision is concerned. Tobacco also reduces your altitude tolerance, partly by cutting down on your supply of oxygen and partly by increasing the rate at which your body uses oxygen.

The carbon monoxide which results from the incomplete combustion of tobacco is the very same gas that comes from the engine.

Incomplete burning of tobacco puts a small percentage of carbon monoxide in the smoke and whether you inhale or not, the carbon monoxide is absorbed by the blood stream *in place of oxygen*. If you do inhale you simply make things easier for the carbon monoxide. When the blood stream is loaded with carbon monoxide, any oxygen trying to get in finds all the parking spaces occupied, and so proceeds blithely on its way.

Blood Absorbs CO Fast

The fact that blood actually prefers carbon monoxide to oxygen and absorbs it 210 times as readily makes things worse. If you're a heavy smoker, you can get as high as 10 percent carbon monoxide blood saturation. It takes only three percent to cause measurable impairment of functions, such as vision, and altitude tolerance.

With the 10 percent concentration possible by heavy smoking, you are halfway to the 20 percent stage. With 20 percent saturation you are in pretty bad shape, and might not be able to continue reasonably safe control of your aircraft because of throbbing headache, visual impairment, reduced power of concentration, and muscular incoordination.

Insidious Effects

One of the insidious things about CO poisoning is that you are subject to sleepiness, reduced mental and physical powers and some *loss of vision* prior to any recognizable symptoms, such as a headache.

If you have been smoking steadily, you have enough carbon monoxide in your blood so that at 10,000 feet altitude your body acts as though it were at an altitude of 14,000 or 16,000 feet. Your vision will be correspondingly affected.

In fact, smoking just three cigarets in a relatively short period before takeoff will *reduce your night vision as much as the effects of 8000 feet of altitude.* One cigaret results in a saturation of 1 to 1.5 percent of your hemoglobin with carbon monoxide instead of oxygen.

Once carbon monoxide enters the blood stream it leaves very slowly, like alcohol. About half of it is still present at the end of 6 hours, and there may still be some left at the end of 24 hours.

Effects of Nicotine

At the same time another product of smoking causes problems — namely, nicotine. Nicotine raises your requirement for oxygen by 10-15 percent. A further adverse effect of nicotine is its interference with your reactions. It also increases your nervous instability and tires your mental processes. Night vision is reduced, and your depth perception can really get knocked off center. A smoldering cigaret also produces ammonia which irritates the eyes.

The pilot who wants to fly at optimum efficiency and safety will try to reduce his smoking, especially just before flights, and most especially before night flights. ●

TAKE

LOOK

HAVE YOU ever looked at the ocean from 40,000 feet? It looks like the surface of a millpond on a calm day. Any pilots could set a plane down on that kidsize swimming pool. At 5000 feet a few whitecaps become apparent, but what is different about landing a plane on the water? The only difference is that you can select a heading directly into the wind so there is no crosswind to worry about and there are miles and miles of nice soft runway. Gosh, seaplane operations must be a snap!

At 500 feet the few whitecaps have now become a frothing mass of foam and it becomes apparent that your decision to ditch made at 40,000 does not look so good at 500. However, it is too late to eject! You have now committed yourself and it is too late to change your mind. You are lined up into the wind—or are you? Can you tell the wind direction from wind streaks and whitecaps—or is there a possibility that you are coming in downwind.

Now the swells begin to appear below the whitecaps. These long, rolling, slow moving masses of water may be 10 feet high.

Seaplane pilots have as much respect for the swell as for the wind, and perhaps more. They will hold a plane in a power stall just above the top of the swells and cut the power to drop it in at just the right moment. You are going to do it deadstick in a jet? From this point on that word dead is going to have a mighty personal ring.

At 50 feet you are leveling off, but the sea no longer looks like runway 28 or the deck of the old *USS Wolverine*, or the old millpond. It is frothing and churning and unfriendly, and definitely not the place you would have selected for a landing had you realized what it was really like.

Let's look at a few facts. Assume that you are landing into a 20-knot wind. Your best glide speed is 160 knots. You break your glide about 250 feet. But with the radio altimeter inoperative because all of the battery juice was used up attempting airstarts and screaming "Maydays," how do you know when you reach 250 feet? With no previous experience in estimating height above the water, it won't be easy. If you are lucky enough to do it just right, you will touch down with a relative speed of 110 knots. A seaplane pilot thinks a long time before landing a plane in the open sea under similar conditions and he is flying a plane designed for water operations with a forward speed of 55 knots—just half of your speed. Still think you can do it? The records say you can't.

Just for argument, suppose your original observation is correct. Suppose the ocean is like a millpond. Is this going to make it any easier? A P-boat man will tell you that this is one of the worst possible conditions. Here he would make a power-on instrument approach until contacting the water and then cut his power. If you had this much control you'd fly that "cold stove-pipe" back to the flat-top and trade it in for a hot one.

Your initial touchdown may remind you of the hydroplane events of the President's Cup regatta, which you saw on TV, as you touch down on the top of a swell and carom back into the blue; or you may plow into the back of the swell, in which case you will swear the water is frozen as your aerial hotrod crumbles on contact. Sooner or later you will hit hard and a wall of green water will probably inundate the cockpit. As forward motion stops you will have just a few seconds to leave the crumbled cockpit before it sinks into Davey Jones' locker. Don't forget that pararaft. It will provide some comfort, lots of signaling equipment, and the raft will be easier to spot from SAR aircraft. ●

THE AIR WITHIN YOU

FOR the folks who sunburn their tonsils gaping at the high borne antics of aviators, air and the oxygen in it is about the most abundant commodity yet untaxed. For the citizen in the cockpit whose requirements for the stuff we breathe is just as important, the term "free as the air" has certain limitations.

Whether tax-free or not, whether you gasp it or sigh it, snort, sneeze, whistle or cough it, air and its unseen O_2 content can become about the most valuable thing you never saw.

And because it's pretty firmly established that airplane drivers can't aviate at altitude for very long without a proper lung filler, there have been developed some very fine gadgets and systems to make breathing almost as easy as breathing. Perhaps for that very reason, the people who populate planes are prone to overlook the vital importance of *knowing* that equipment and its operation. This amounts to an ignorance which is neither blissful nor healthy.

So you figure *you're* all checked out with the word on this respiration-inhalation routine, hmm? Well, that's mighty fine, and the folks who designed the equipment would be real pleased, if it weren't for the number of reports that keep coming in about pilots who got themselves into trouble because they thought they knew all about it too!

Give a listen to just a couple of instances where gents became quite breathless over nothing—the nothing being absence of oxygen. Then think back to a time when maybe you could have had the wind taken out of your lungs by treating this matter too airily—and think ahead to a time when you might just breathe a little easier in the complete knowledge of your capabilities and equipment. That air can be mighty important!

There was, for example, the curious case of the "Lost Hour."

"I took off on a routine hop, climbed slowly to 25,000,

where I did acrobatics for an hour. I could see the field all the time, except for a cloud floating by now and then. Then I noticed my watch didn't agree with the clock, so I called the field and they gave me 1602. I set the clock, I remember that—and that's *all* I remember—until I realized I was making another time check—at 1700!

"I was at 7000 feet, with my mask off, and I sure don't know how I got there, or how come I wasn't at 0000. Mostly luck. I think I was trying to control the *Corsair* a little—and I remember that I was having the time of my life—never felt better in my life, but I don't remember anything definite. I must have taken my mask off myself—I usually do at 10,000 feet.

"Well, when I started functioning again, at 7000 feet, I didn't know where I was. I tried lost plane procedure but I loused it up good.

"I'd read a frequency from the book, and I couldn't remember it long enough to tune it in on the radio!

"After about 20 minutes of this I gave up, and called for help, got a heading, and landed at another Navy field at 1730. I stayed there 45 minutes, and then headed for home, at 3000, landing at 2030.

"I had had 100 percent oxygen for 25 minutes, and diluter demand for 65 minutes on the way home, but when the flight surgeon saw me half an hour after I landed, he said I still showed effects of anoxia — my fingernails were still bluish.

"The oxygen equipment in the plane tested O.K., so I guess the mask either disconnected during acrobatics, or more likely it wasn't fastened tightly enough when I took off — I'll sure check it from now on. I'm practically living on borrowed time. That lost hour was nearly my last hour!"

Or take this equally impressive account of a ferry pilot who more or less misplaced a landing. Seems this pilgrim, after completing one 3-hour and 15-minute leg of his trip, at 10,000 feet, paused about 45 minutes for a service stop and resumed the flight. Again at 10,000 feet, without a mask but occasionally breathing through the oxygen tube, friend pilot flies for about 2.5 hours before arriving at his destination. Because of the heat, the pilot had removed his hardhat and loosened his shoulder straps and safety belt.

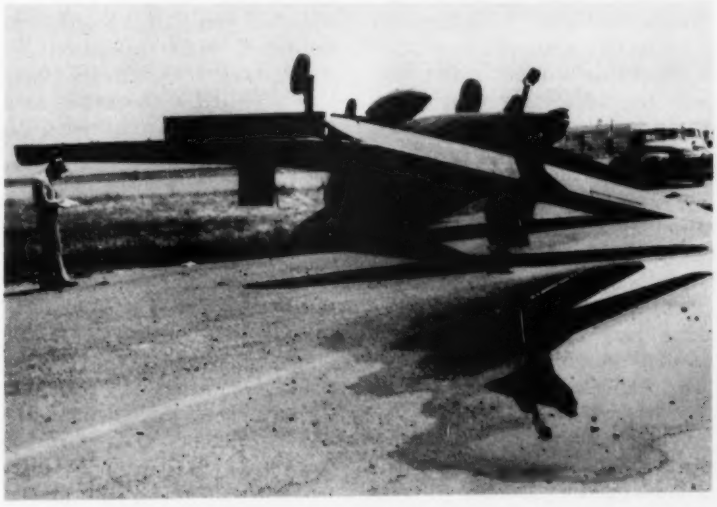
During the last half of this leg, the pilot recalls that "events were not clear to me," and did not recall transmissions which he made on approaching the field. Although there was a thunderstorm in the vicinity of the field at the time of his landing, the pilot does not recall being aware of it, saying "I feel that I would not have landed in a thunderstorm had I been in full possession of my faculties."

But land he did, and swerved off the runway and flipped over on his back, the loosened shoulder harness and unworn hardhat netting him a laceration and concussion. Fortunately, no fire resulted for it was some minutes before he could be removed from the cockpit.

Understandably, the board concluded that the pilot was suffering from anoxia, and that "oxygen should have been properly used by the pilot on this prolonged flight at or near 10,000 feet."

Yep, he got away with it, barely—and it can only be hoped that he is spreading the word about O_2 and *you!* ●

The pilot did not recall many of the events leading up to his approach and accident.



EXPLOSIVE DECOMPRESSION

AN AIRCRAFT at 27,000 feet was forced to penetrate the top of a thunderstorm. Hail carried by vertical currents broke the driftsight cover causing a cabin decompression to 17,000 feet. Severe turbulence prevented descent for 12 minutes, during which time oxygen was administered to passengers.

What about you, if hail or some other phenomena breaks your canopy, causing rapid decompression? The experience may be new and frightening but the dangers are old familiar ones. Let's see what you can expect.

Rapid decompression takes place in several seconds. If the decompression occurs in one second or less it is termed "explosive decompression."

There is no explosion but you may feel like your body is doing the exploding. There is a feeling of sudden expansion of air in the lungs. That air and trapped air in your stomach bursts out of your mouth and other outlets with great violence. (open airways).

As one pilot said, "I felt as if I had my tongue almost blown out of my mouth." Your cheeks and lips flap as the wind goes out.

It is a little like having the wind knocked out of you without being hit. The air in your inner ear will rush out rapidly through the Eustachian tubes (which open readily to let air *out*).

As violent as all this feels, you're not likely to be injured. *It doesn't floor or stop you.*

When you recover from the initial reaction your problem is to go down before you pass out from anoxia or have an attack of bends.

If you didn't lose your oxygen mask, and you probably didn't if you had it secured as required, your pressure demand oxygen system will keep you supplied with oxygen at a sufficiently high pressure until you can descend.

Suppose you lost all your oxygen equipment? Hold your breath if possible and dive to a 10,000-foot altitude.

If your accident occurred above 43,000 feet, even breathing oxygen under pressure won't prevent anoxia because your circulatory system fails from lack of pressure on the body and can't transport the oxygen.

At 53,000 feet your time of useful consciousness without *pressure* suit with oxygen is only 10 seconds. Dive to a safer altitude quickly. The rapid recompression won't harm you. At worst you will have to swallow to open your ears.

After you reach safety at 10,000 feet go home because you may have some delayed after-effects from shock or altitude, such as dizziness, nausea or unconsciousness. This is no longer your best day to fly.

In short, remember:

- Below 43,000 it's bends and lack of oxygen.
- Above 43,000 it's bends, lack of oxygen and circulatory failure from lack of pressure.
- Use 100 percent oxygen and pressure suit.
- Dive for 10,000 even though you have oxygen and pressure suit.
- Go home. ●

Editor's Note: This article was prepared at the request of Composite Squadron THREE for information on this increasingly important subject.

EJECTION ACORNS

REMEMBER the one about ". . . great oaks from tiny acorns grow?" There's a parallel to this adage that might be put as "Large difficulties from small errors result," and applied to the flying business, this can be a painful lesson to learn first hand.

Take the business of ejection for example. So you've had the standard check-out and maybe a refresher, and when the time comes to depart the premises of your sky buggy you go about the procedure in a pretty orderly, well-planned way. But sometimes and otherwise well-planned, well-executed ejection can be marred by minor difficulties that may well snowball into a major problem. Sometimes these difficulites are merely inconvenient or briefly frightening, but sometimes they can be lethally serious.

Unusual situations which develop in an actual ejection experience may never have been anticipated. Other problems come from disregarding SOP. From the survivors come "beneficial suggestions" in a nutshell.

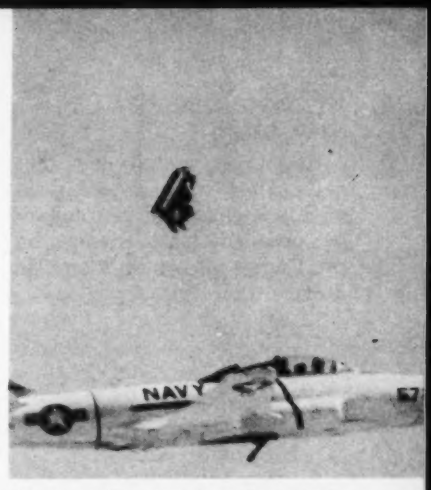
An F9F-5 was in a nose-down spiral at 350-400 knots, with no stick control. At 4000 feet the pilot decided to eject, and pulled the face curtain with both hands. As he left the cockpit at 1500-2000 feet he felt his right shoulder being thrown back. He used his left hand to release the safety belt and to pull the ripcord, since he had no control at all over his right arm. He hit the ground almost immediately after the parachute opened. It is estimated that the ripcord was pulled at an altitude of 500-1000 feet, with the chute opening at 200-300 feet. The pilot was in a horizontal position when the canopy opened and he struck the ground in soft marsh on the first swing.

He received no further injury on landing, and was rescued in 45 minutes by helicopter. He had received the seat ejection lecture and ground ejection shot the morning of the accident. He gave it full credit for his survival, "I feel that the indoctrination that I received on the ejection seat probably saved my life."

Dislocation of the right shoulder by windblast as experienced in this case can usually be avoided by the standard procedure of grasping the face curtain handle with palms in and tucking the elbows in tight to the body when pulling the face curtain and pulling with a straight downward movement. It also is advisable, when altitude permits, to remain in the seat until it decelerates.

Another case points out the need for increased emphasis on remaining strapped in the seat for ejection at altitudes above 2000 feet; and for frequent mental rehearsal of the ejection procedure in order to hasten the decision and the ejection when in trouble. The pilot in this case had a flameout in an F9F-7 with heavy load of fuel aboard.

When he decided to eject he first undid the catch for the lap belt shoulder harness. Then he put his feet in the stirrups, pulled the pre-eject lever and drew the face curtain at an estimated 4800-foot altitude. He let go of the seat to which he was clinging by the shoulder harness, and pulled his D-ring. The parachute opened normally and he made a safe landing and was soon picked up by helicopter.



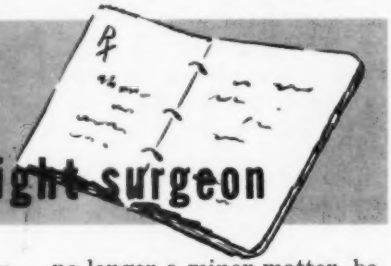
This is strictly a test, but when you do it for real, follow SOP.

He was suffering from lumbo-sacral strain, aches and stiffness in his lower back and thighs. He thinks his feet flew out of the stirrups when the ejection seat fired, and that the edge of the seat slapped his thighs.

He had not yet ridden the ejection seat trainer, but had seen the movie the day before his accident. He did not follow standard procedure in that he unfastened his disconnect prior to ejection, although he was well above 2000 feet.

Summed up, standard procedure is the standard to aim for—SOP is the means to the end, the *proper* end, which is a well-planned, well-executed ejection,

NOTES from the flight surgeon



SPEAKING OF SEEING—HEAR THIS

Good day vision does not necessarily mean good night vision. Poor night vision may be doubled in efficiency by practicing off-center vision in a dim light.

One reason for completely dark-adapting before you leave the ground is that adaptation takes longer than the average 30 minutes if you are at the reduced pressures of higher altitudes.

Because of night visual problems, the size of objects is important. You obviously can not increase the size of the plane you are chasing; so night technique is to follow a plane from slightly above or below instead of trying to watch its smallest silhouette —which is from directly to the rear.

NIGHT AND DAY

Double-ended night and day flares are designed to emit 20 seconds of smoke in the daytime and a 3000-candlepower flare of 20 seconds duration at night. The day and night ends are labeled, but when it is too dark to read, the flare can be identified by the raised nubs on the periphery of the night end.

Remember: night flight is rougher—and the rough end is the night end.

KEEP IT CLEAN

Since far less light is available for night vision, the pilot's ability to see through the windscreen is more easily impaired.

The light absorbed and reflected by the windscreen is no longer a minor matter, because it is a considerable proportion of the light available. The decrease in contrast between an object and its background because of possible reflections of light within the cockpit is also magnified in darkness.

Dirt distorts light rays, destroys contrast.

For these reasons, dirt, grease, and scratches on canopies and windscreens are a serious handicap at night.

TURN IT ON

Two recent accidents, one of which was fatal, have resulted from hypoxia. *In both cases it was determined that the pilot had failed to turn the oxygen regulator shut-off valve to the ON position.* Preflighting of the oxygen system in accordance with Aircraft Clothing and Survival Equipment Bulletin 7-54 would have prevented this.

Turning the valve to the OFF position when not in use relieves the regulator of the strain of constant pressure, and also precludes loss of oxygen supply by inadvertent operation of the safety pressure switch. *But when you hook up, turn it ON!*

SLIPPERY GLOVES IN DITCHINGS

BuAer has received reports from pilots who have had difficulty in removing their oxygen masks after ditching because of inability to grip the mask suspension straps firmly with wet flight gloves. There were requests that a material be used in aviators' flight gloves which affords a and it is considered at present that such treatment would materially reduce the life of flight gloves and would not afford a satisfactory item.

A number of modifications of oxygen mask suspension straps have been tested to de- non-slippery surface when wet.

The treatment of leather gloves for non-slip characteristics has been investigated, termine the best method of providing a positive grip for removal of straps from the flight helmet under emergency conditions. Results of these tests indicate that a simple modification of the mask straps, by sewing additional webbing to the end of the tab to form a bead, will assist in prevention of slipping of the strap when grasped with wet gloves.

Editor's Note—

A BuAer Aviation Clothing and Survival Equipment Bulletin (ACSEB) is being issued to cover the procedure for making the recommended modification of oxygen mask straps.

Perhaps in no other phase of hydraulic maintenance is the system so vulnerable to contamination as during servicing operations. Equipment like this helps but—there are so many ways fluid can be contaminated *before* it enters the system. For that story please turn the page.

Keep It Clean

THE hydraulics chief put it this way, " . . . in this business, cleanliness is next to Godliness." BuAer says it this way; "the importance of maintaining hydraulics systems absolutely clean is emphasized by many reports which indicate that the presence of foreign matter in hydraulics systems is one of the chief causes for malfunctioning of component parts in the system, and is therefore the direct cause of many accidents."

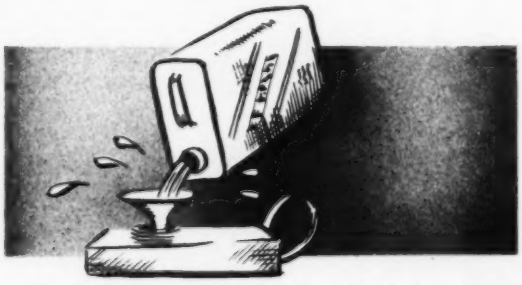
So it be. Anyway you say it, it means cleanliness to a degree of immaculateness. This high degree of cleanliness is demanded more than ever by today's aircraft which are no longer controlled by manpower alone. Hydraulic power is now widely employed to provide control surface power made necessary by larger surfaces and higher speeds. The substitution of manpower with hydraulic power demands high precision components. To insure controls of instantaneous and identical response requires hydraulic equipment with valving tolerances as low as .00005 inches. Obviously even particles so minute they escape detection by the naked eye could render such equipment ineffective.

Perhaps in no other phase of hydraulic maintenance is the hydraulic system so vulnerable to contamination as during servicing operations. As an illustration, take the case of a recent accident which was caused by a contaminated hydraulic system. It stemmed from a contaminated portable test stand which investigators said had lacked proper servicing. The aircraft's hydraulic filter disc seal was ruptured, allowing passage of contaminants. The disc seal rupture was caused by retaining spring penetration. It is of note that care is required when installing filters to insure that the spring does not terminate in a sharp point or knife edge and no incipient cracks are present in the disc.

To eliminate this kind of dangerous contamination, application of the procedures contained in NavAer 03-30-575, handbook concerning "Usage and Handling of Fluid Used in Hydraulic Systems of Naval Aircraft," becomes mandatory. To refresh our memories let's review briefly the fundamentals of keeping a hydraulic system clean. Knowledge of them can save us much work and what's more important, it may save a life.

Here are 17 pertinent questions with ready answers which were gleaned from NavAer 03-30-575, the hydraulics bible:

1. Q. *Why is hydraulic fluid supplied in one-gallon containers?*
   A. To minimize the chances of contaminating the fluid. Experience has shown that when fluid is in larger containers contamination may occur by: (1) Transferring the fluid into smaller, dirty and contaminated containers for ease of pouring into the aircraft hydraulic system and (2) leaving the fluid standing in uncapped and partially filled cans.



2. Q. *Is it permissible to pour fluid from the original one-gallon container into another container?*
   A. No. Fluid shall be poured only into the system.

3. Q. *What to do with leftover fluid?*
   A. The remaining fluid in one-gallon containers which have been opened and not emptied on the same day in which they were opened shall be discarded and the container destroyed.

4. Q. *Can empty containers be reused?*
   A. No. All containers which are empty shall be destroyed immediately and not used to store or handle any other fluid.
5. Q. *Can fluid drained from hydraulic systems or equipment be reused?*
   A. No.
6. Q. *What happens when hydraulic fluid is exposed to the air?*
   A. It will absorb dust, grit and lint.
7. Q. *What rules apply to handling equipment?*
   A. All handling equipment must be kept clean and shall be used for handling hydraulic fluid only.
8. Q. *What precautions should be followed concerning the use of funnels?*
   A. If use of funnels is necessary, they must be absolutely clean. Do not assume that the finger strainer will catch the dirt. *Caution*—Do not jam a funnel into the filler neck of the reservoir that incorporates a finger strainer. Such action will damage the finger strainer, which in turn, is a potential source of metal particles which will result in damage to hydraulic system components.
9. Q. *What precautions are necessary when using portable test stands, hand pump units or pressure bleeder units for filling hydraulic systems?*
   A. They shall be maintained with the highest degree of cleanliness. All units must contain separate proper type filters, which shall be replaced at regular intervals.
10. Q. *What is filtering?*
    A. Filtering consists of merely flowing the fluid through an external filter, reusing the same fluid and all filters changed. Each component shall be activated through all phases of its operation at least five times while fluid from the portable test stand is circulated through the system so that all fluid is filtered.
11. Q. *What constitutes regular intervals for replacement as applied to filters?*
    A. Aircraft and portable test stands; replace after each filtering operation. Bench test stands, every 15 days.
12. Q. *How often are systems filtered?*
    A. Aircraft not equipped with micronic filters, every 120 hours. With micronic filters, 240 hours.
13. Q. *What is flushing?*
    A. Flushing consists of completely disassembling the entire hydraulic system and all components and lines cleaning each with an approved solvent.
14. Q. *What solvents are approved?*
    A. For red and amber colored fluids, Stoddard Solvent; for blue, alcohol.
15. Q. *When are hydraulic systems flushed?*
    A. When metal particles, sticky or gummy substances, rubber chips or other extraneous solid matter is found in the system.
16. Q. *What should the capabilities of a portable test stand filter be?*
    A. Micronic filters should be capable of removing particles larger than 10 microns in size, (.0004).
17. Q. *Where can I get my hands on a copy of this informative handbook?*
    A. If it isn't available in your maintenance or technical library order one from your nearest Aviation Publications supply office today—you'll be glad you did tomorrow.

At this point we've only skimmed the handbook of the fundamentals of maintaining cleanliness in and about hydraulic systems. However, the application of these principles, the common sense practice of always covering ports and capping open lines will go a long way towards eliminating contamination of hydraulic systems. In a nutshell, remember what the hydraulics chief said, "Cleanliness is . . . " ●

From The Ground Up

YELLOW SHEET CERTIFICATION — The significance of preflight inspection and the certification that an aircraft is ready for flight was reemphasized by this accident which involved an HTK model helicopter.

The 'copter was signed off as ready for flight prior to completion of a major check. The check had two major items to go; tracking of the rotor blades and a check for equal rotor cones. This latter check entails adjustment of the rotors of the syncopter until the lift of the rotors are equal and the forward and aft apexes fall on the vertical centerline. If the lift of the rotors are not equal the helicopter will turn toward the rotor with less lift.

A pilot was informed by the line chief that the aircraft needed a test but that he did not know the condition of the aircraft. Unable to contact members of the check crew or the maintenance chief who were at noon chow to determine the reason for test, the pilot attempted a test flight relying on the yellow sheet which was signed off by a mechanic.

With one passenger aboard the pilot proceeded directly into the hover test. When power was applied for normal takeoff the aircraft left the ground and began a violent turn to left and moved rearward. Realizing he did not have rudder control the pilot reduced power to land immediately. The helicopter overturned on contact of the left landing gear with the ground.

The YELLOW SHEET was signed before the check was completed.

The rotor blades shattered, injuring two bystanders some 70 feet away. Flying fragments also penetrated a hangar 100 feet away and damaged two other helicopters 90 feet away.

The pilot was assigned primary error in that he did not ascertain what work was done by the check crew, therefore he did not know what flight characteristics should be given particular attention; he did not use the pilot's check-off list; failed to make a ground taxi check (this was due to a congested area in which the HTK was parked) and he did not gradually apply collective lever until the weight of the ship began to leave the landing gear struts and test for positive rudder control.

Secondary error was assigned to other personnel in the main for:

a. One member of the check crew filled out the yellow sheet certifying the aircraft

was ready for flight prior to actual completion of the rigging.

b. The line chief was given the word that a test pilot was needed but was not informed of the reason for the test.

c. The plane captain did not know the proper way to check for equal rotor cones.

d. Lack of close liaison between maintenance and line as to aircraft condition and status in this instance.

In order to reduce and when possible eliminate the multiple factors of human error in flight test procedures the board made the following pertinent recommendations:

1. That pilots use a preliminary check-off list with items of ground-check listed. After ground-checking the listed items the list be returned to the plane captain in order that he then may certify the aircraft for flight readiness.
2. Require test pilots to consult the mechanics to determine what work was accomplished, the condition of the aircraft and the reason for the flight test.
3. Require written instructions for the scheduling and control of test flights. Such instructions would establish more definite zones of responsibility.
4. That an area well removed from other operational activities be set aside for turnup and takeoff of helicopters undergoing test.
5. That plane captains be instructed in the proper method of checking equal rotor cones on all flights.

NOTES AND COMMENTS ON MAINTENANCE

HAZARD ELIMINATION—Upon discovering a potential hazard which existed because of the similarity of J46 and J65 engine starter-generators, electricians of Oceana's FASRon Five urged wide dissemination to all hands concerned with removing, installing and testing these accessories.

The report warned that these starter generators are identical in size, weight, color, mounting and connections but have opposite rotations. If installed upon the wrong type engine an explosion may result in a light off attempt. When viewing these starter-generators from the commutator end, Type 2CM77D3 for J-46 engines has a clockwise rotation; Type 2CM88D4AB, counter-clockwise. *Identification can only be made by observing the part number stamped on the nameplate.*

Details of this condition were submitted to cognizant authorities for action. For this positive approach to aviation accident prevention we tip our editorial hats to Chief Radio Electrician J. J. Davis and Chief Aviation Electrician's Mate B. Rangeo!

TRIANGULAR AFFAIR—To replace the seal of the port main gear hydraulic cylinder in an F9F-6 maintenance personnel used jacks on the two main gear points, and as had been the custom for this operation, a ground-lock device was used on the nose gear.

When the gear handle was actuated the nosewheel unlocked, broke the ground-lock device and collapsed. The up line of the hydraulic sytem had not been capped. The aircraft sustained considerable damage.

This type operation had been used successfully by the reporting activity on previous occasions. However, the unit reports it has discontinued the practice in favor of three point jack system for all future maintenance work necessitating elevation of aircraft.

POSITIVE PREVENTION—When a TV-2 struck both main wheels on the lip of the runway, bounced 15 feet and landed, little evidence of damage was visible upon the plane's return to the flight line.

Unsatisfied with outward appearances, however, personnel of Headquarters and Maintenance Squadron 11 conducted a complete disassembly of the airplane as a positive check. As a result of this inspection it was determined that Class Charlie damage had been sustained by the airplane requiring a total of 33 replacement parts.

Obviously, as stated in the first endorsement of the aircraft accident report, this thorough going inspection prevented another potential accident.

FROM THE

GROUND UP

CONTINUED

BEACHING TECHNIQUE—Upon making the ramp buoy a P5M-2 sustained a ruptured and buckled port wing float when its port main beaching gear mount came off. The cause of this accident was attributed to negligence on the part of the plane crew.

After the beaching gear was attached the first radioman signalled the beachmaster with a "thumbs up" indicating all beaching gear attached and the aircraft ready to be hauled up the ramp. The beachmaster had the aircraft pulled partially out of the water, then stopped in order to make his normal inspection of the beach gear mounts. He noticed the chine pins on the port main beaching gear outside the hull chine. The aircraft was resting only on the saddle assembly pad. The aircraft was eased back into the water and the port main beaching gear mount came off causing the port wing float to strike the edge of the ramp.

Investigators said the chine pins were probably never fitted into the chine holes. The binding of the saddle assembly pad was sufficient to hold the mount perpendicular. A visual check would have disclosed this condition due to the mount of clearance between the gear flotation tank and the side of the aircraft. A still better check is to attempt to tilt the mount away from the aircraft after the chine pins have been raised.

As a result of this accident the squadron concerned revised its beaching and ramping instruction to include these safety checks. In addition, the plane captain will be required to personally check each mount for proper attachment before allowing the aircraft to be hauled out of the water.

DOUBLE ERROR—Errors on the part of the elevator operator and the elevator safety man resulted in considerable damage to the tail section of an FJ-2. The aircraft was being moved from the flight deck to the hangar deck on the deck-edge elevator. It was pushed off the elevator into hangar bay and stopped with about three feet of the tail section still on the elevator. The elevator was raised and struck the underside of the aircraft.

The accident was attributed to two errors: the elevator safety man failed to throw the elevator safety switch to the OFF position after the elevator was stopped in the full down position; the elevator operator failed to sound the warning horn before raising the elevator.

LINE SWITCH EXPLODES INSTRUMENT—The vacuum and pressure lines of the needle ball instrument in an F9F-2 were reversed during installation. Subsequently on takeoff and as the aircraft reached approximately 100 knots the needle ball instrument exploded into the cockpit.

The pilot, who was wearing a helmet equipped with an eye shield, reported his eyes were protected from flying glass and no injuries were sustained. The flight was completed without further mishap.

Obviously no new cause factors were discovered as a result of this near-accident and the old, old formula "indoctrination, supervision and inspection" still holds true.

RUBBER PARTICLES—A particle of the rubber inner liner of the hose assembly lodged in the .052 orifice of the restrictor check valve of the port main gear of a TV-2 and was the cause of a recent wheels-up accident. The obstruction created a hydraulic lock in the actuating cylinder.

Rather than land with one wheel up the pilot raised the extended gear to permit a wheels-up landing. As a result, damage to the aircraft was slight in that only the landing and dive flaps required replacement.

As the aircraft had been flown only 154 hours since acceptance, it is believed by the AAR Board to be an isolated case. The hose installation had been made at the factory. However, the board stressed the importance of inspecting hydraulic lines for cleanliness and obstructions by all activities during hose installation.

PLUGS AND TORQUE—The stripped threads and broken barrel are evidence that either the wrong tool or brute force was used to install these sparkplugs. Damage to cylinders in two AD aircraft engines was so intensive that

repair was impossible. Replacement required 82 man hours plus the considerable expense of parts. The use of torque wrenches to install AD sparkplugs at 300-350 inch-pounds is prescribed. Overtorquing even slightly can change point settings two or three thousandths and cause malfunctioning and misfiring plugs.

LOOSE NUT—The loosening of the lock nut on the elevator stop bolt of an F3D aircraft brought about a recommendation that the lock nut be staked to prevent future occurrences.

In this particular instance the loosening of the lock nut permitted the elevator stop bolt to back out, thus reducing elevator down travel to approximately two degrees instead of the normal travel of 9.2 to 9.7 degrees. This situation is considered to be extremely hazardous in flight.

Inspection of other F3D aircraft by the reporting activity failed to reveal similar discrepancies and this instance was considered to be an isolated case. However, the reporting activity recommended staking the lock nut to prevent future occurrences.

HO5S ACCESS DOOR CHECK—The pilot's access door of an HO5S-1 came off during flight, flared upward and was struck by the rotor blades. A precautionary landing was made, rotors inspected and the door recovered.

After investigation the accident board assigned faulty material and design, plus incomplete maintenance as causes of the accident. Maintenance was considered incomplete and not faulty in that 120-hour checksheets do not have specific references to the roller assembly or channel assembly.

In addition to suggesting a design improvement to preclude recurrences of this type, the accident board recommended a more detailed check of the sliding door assembly to include roller and channel assemblies every 30 hours instead of 120 hours. It also recommended addition to the check sheets the following inspection items: Release all emergency exits; inspect controls and locking mechanisms for positive release, freedom of movement, wear, corrosion and secure engagement; inspect seals for deterioration, inspect bearing assembly for rigid alignment in track; inspect channel assembly for inboard 90-degree bend in alignment with outboard 90-degree bend.

SHADES OF FOUL PLAY—An SNJ experienced a complete loss of power immediately after takeoff due to failure and malfunction of eight sparkplugs. The accident board was unable to determine why the sparkplugs failed on this aircraft. Due to extremely low altitude at which this power failure occurred, neither the pilot nor student observed any instrument readings or other indications to aid in determining why the engine failed.

The engine was sent to O&R for a detailed analysis of the sparkplugs involved and disassembly of the engine to determine if any other factors not known to the accident board could have caused this accident.

The accident board recommended that the contents of CNATra Aircraft Technical Letter 6–55 of 27 Jan 1955 on sparkplug fouling, general information concerning, together with details of this accident report, be routed to all pilots for signature. It is a guide for diagnosing and correcting various types of sparkplug fouling.

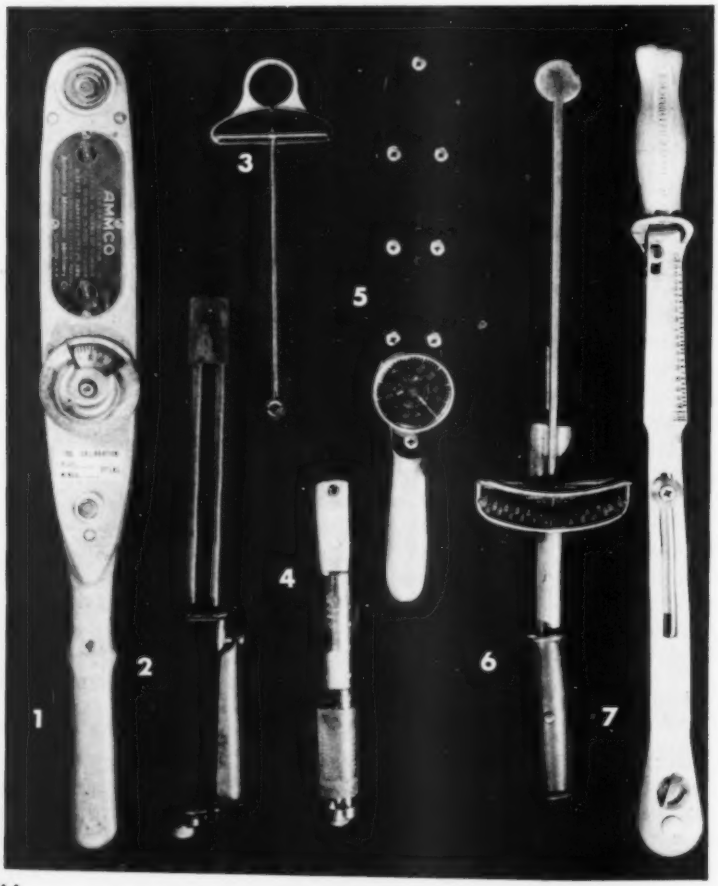
The technical letter recommends that operating activities establish procedures which are applicable to their specific aircraft models and which prove, by practical application, to be effective for these aircraft. •

How important can it be?

Gone are the days when a mechanic could cinch up a nut, give it a half turn more and have the feeling that he had torqued right. The increased number of accidents caused by improper torquing provides warning and proof that the proper application of torque is one of the most important accident prevention factors.

Design specifications for practically every nut, bolt, screw or similar fastener used in assembling components of modern aircraft require that each function properly under maximum conditions of stress or strain. However, before these fasteners can function properly they must be preloaded during installation by tightening within certain torque limits.

These torque limits are among erection and maintenance specifications of the aircraft and are listed in the applicable handbook of maintenance instructions. Other technical publications such as service changes, airframe, accessory and engine bulletins may contain special torque values, however. In any case, to properly apply these torque values a torque wrench *must* be used.



Variations of the two basic types of torque wrenches include:

1. AMMCO (rigid frame)
2. APCO (flexible beam)
3. DURO (flexible beam)
4. PROTO (rigid frame)
5. SNAP-ON (rigid frame)
6. STURTEVANT (flexible beam)
7. WILLIAMS (flexible beam)

Torque wrenches are manufactured in various designs but there are only two basic types, the flexible beam and rigid frame. Examples of each are illustrated here. All are torque wrenches and all give the same torque readings when in like calibration. (Details of design, care and use of torque wrenches are contained in "Let's Talk Torque," December 1955 *Approach*). The means of indicating torque readings vary from a simple dial reading to pre-set limiting types which snap through when the specific torque resistance is reached. Whatever the indication, remember *it's the amount that counts.*

At this time when the ability of the fleet to provide increased combat capability is handicapped by training deficiencies, shortages of trained personnel, and lack of special tools and equipment, make sure your unit has the proper tools and equipment and is trained in their use. In the case of torque wrenches, "to torque right, tool right!"

YE OLDE SONIC WALLE *(Continued)*

In doing high mach work, the effect of altitude is extremely important.

a symmetrical pushover, split S, or 90-degree peeloff).

As the nose goes down the mach number will wind up steadily until it reaches a maximum somewhere between 30,000 and 25,000 feet. Below 25,000 feet the mach number will drop off as the airplane enters the denser air of low altitude and at about 15,000 feet you should start thinking about recovering before you become a statistic.

As a quick rule of thumb, do not go lower than 15,000 feet at 90 degrees, lower than 10,000 feet at steeper than 60 degrees, lower than 5000 feet at steeper than 30 degrees or lower than ground level at steeper than 0 degree and you'll be okay.

Above 25,000 feet the maximum attainable speed envelope of a given airplane opens up as altitude decreases. Up here it is reasonably easy to get past 1.0 mach number in a moderate angle dive.

Below 25,000 feet the maximum attainable speed envelope is closing in as altitude decreases and down here even vertical dives don't give sensational mach numbers. The chances of exceeding mach 1 below 10,000 feet in this airplane and living to tell about it are nil.

Another factor favoring high mach work at high altitude is that the indicated airspeed and dynamic pressure are less for the same mach number than they are at low altitude. Dynamic pressure is air force and the greater the force the more your machine will bend. As for altitude then, do your high mach work at high altitude—the higher the better and somewhere between 45,000 and 25,000 feet for the F9F series.

Other than altitude, there are additional factors which affect ability to achieve a very high mach number. Some of these are the condition of the airplane and engine, the weight of fuel aboard, the air temperature, the air temperature gradient with altitude, the wind gradient with altitude and the direction of diving. Naturally, the cleaner and sleeker the airplane and the better the engine the faster the crate will go.

The weight of fuel is important because when the airplane is headed down steeply, gravity and thrust combine in a downward direction to oppose aerodynamic drag in an upward direction. The heavier the weight or the higher the power, the faster you go. This is tempered, however, by the fact that you will not be able to get as high a starting altitude heavy, as you could light, and your rate of acceleration in the dive may be slower when heavy.

Air temperature is important because while drag in pounds for any mach number and altitude combination is independent of temperature, engine power increases with a decrease in temperature. So, the colder the day, the greater the push, and the higher the mach number.

The air temperature gradient is important because if the airplane dives from cold air to warm air the airplane will not reach as high a mach

(Continued on next page)

YE OLDE SONIC WALLE

(Continued)

number as it would if a temperature inversion existed and the airplane passed from warm air to cold air.

The wind gradient with altitude and the direction of diving can have a surprising effect, particularly at shallow to moderate dive angles. Suppose a jet stream of 100 knots blows from west to east between 40,000 and 35,000 feet and there is no appreciable wind at 30,000 feet.

If you are flying from west to east with the stream at 40,000 feet and push over to say a 30-degree dive, you will leave the stream at 35,000 feet with your speed relative to the stream plus the speed of the stream. As you approach 30,000 feet, you will then be flying faster and have a higher mach number due to the helping effect of the stream. The case is like stepping off a moving bus. Relative to the bus, your speed may be small but if you leave it when it is doing 15 mph you will suddenly find yourself passing over the sidewalk at a rate which will allow you to break the four-minute mile.

Not many of us could keep up this pace for long, however, and we slow down to more normal speeds just as will our fast moving airplane. Just the reverse occurs if you fly east to west, bucking the jet stream and dive out of it. The airplane will definitely not reach as high a mach number in this direction as in the previous example.

As an exercise for the student, think about these effects in a climb sometime and see if you can cut your time to altitude by varying your climb direction. This is really nothing new—birds have been using this principle in hovering flight for years.

The foregoing points all add up to the fact that in high mach work you may get considerably different speeds for different aircraft on different days and don't necessarily blame yourself or your aircraft if some days you're a gone goslin and on others you're a dead duck.

Well, okay, we've got this vehicle moving pretty well, but the altimeter is unwinding at an awesome rate (67,000 feet/minute at 1.1 mach at 25,000 feet) and before you can say "Hey Ma, look at me," it's time to start pulling out. Pulling G at supersonic speeds has some interesting points, however, and once again refer to the specific Pilots Handbook and Vg diagram for details on the airplane you are flying.

In the sweptwing F9Fs, more back stick is required for a given G pullout at supersonic speeds than at high subsonic speeds. The airplane will appear to increase its angle of attack more for these G than you expect and you may have the impression that you are mushing through the pullout. As you hold that back stick though, the nose will come up and the speed will fall off. Now watch for a return of effectiveness of that back stick and an increase in G as the speed falls off through 1.0 to .90 mach number. Naturally, the faster the speed drop off, the more apparent the G increase will be. Factors which increase the rate of speed drop off are reduced power, extended speed brakes, high G and low altitude. With G increase, do the natural thing and ease the back stick pressure to hold the G you desire.

Considerable reference has been made in this article to mach number and something should be said about how you know what mach number you are at.

First of all, try to do your high mach familiarization work with an airplane that

has one of the new type combination airspeed and mach indicators. Second—and this may shake you—don't take what it says as the gospel truth in the range from roughly .90 to 1.0 mach.

Those shock waves we discussed earlier are running rampant all over the airplane and some are playing around in the regions of the airspeed pitot head and static orifices. The result is considerable error in the airspeed indicating system in this speed range. See your particular Pilots Handbook for a plot of error *vs* Indicated Mach Number and don't be too surprised in a dive if the needle seems to stick at .93 mach number and then jumps to something past 1.0. If you know the transonic characteristics of the airplane, though, you will always be able to tell your true mach number by the behavior of the airplane—for example wing dropping at .91-.92, change in buffet at .97 and so on.

So much for high mach work and as Navy fighter pilots you probably will get quite a kick out of it. But just a few words for some other people who will also be getting quite a kick out of your high mach work—the people on the ground that you rocked with your sonic boom.

The full story of what makes a sonic boom is material for another article, but in capsule form, remember that whenever you get past mach 1.0 you create a bow wave of air with your airplane just as the *USS Forrestal* makes one at "umpteen" knots through the water. Even after you pull out, your bow wave continues ahead until it reaches the ground just as the bow wave from a large ship can continue on to a beach and raise some fuss as a breaker. The air bow wave is a pressure wave, however, and it makes itself felt audibly or as concussion. This wave goes approximately where you were pointed, its severity depends upon how far away you were, how big an airplane (or how many) you were, and how fast you were traveling.

Current type aircraft can create explosion-like noises, break windows, crack plaster and chimneys, and knock small children off their feet. Newer types can create considerably more damage. So watch where you point your prow when you push that speed out.

In summary, heed the following for high mach flying:

1. Know what to expect. Read the Pilots Handbook and get the word from someone who knows.

2. Know your Vg diagram and the limitations of the aircraft.

3. Familiarize yourself with high mach characteristics at altitude. Start with shallow glides and steepen dive angles as you can gain confidence and experience.

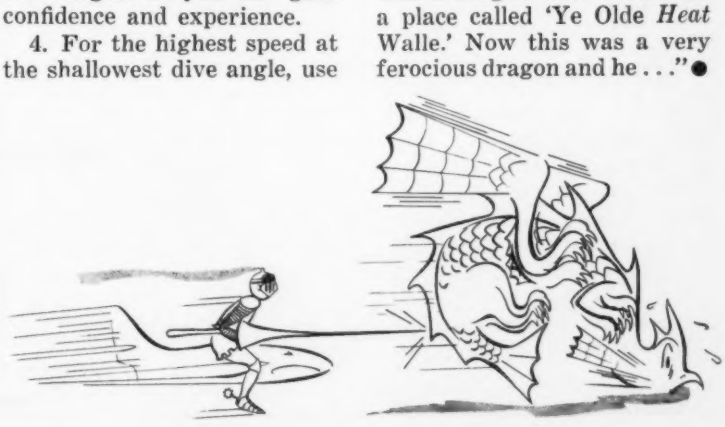
4. For the highest speed at the shallowest dive angle, use full power and keep speed brakes in. (It's also a good idea to check those speed brakes before you start down—just to make sure they'll work if you need them).

5. Avoid diving into a milky smoke or haze condition at low altitudes. Recovery from a high mach dive on instruments may be confusing.

6 Run cabin temperature hot for a while before starting down to heat the windshield armor glass and help eliminate condensation which develops on cold surfaces at low altitudes. Confine your frosty glass research to mint juleps.

7. Don't break the skipper's picture window with a sonic boom.

"Once upon a time there was a dragon who lived near a place called 'Ye Olde *Heat* Walle.' Now this was a very ferocious dragon and he . . ."●



the Tip-tank

Miscellaneous aviation safety information

BEECHCRAFT

Recurrent rashes of premature wheel-retraction of the *Beechcraft* during touch-and-go landings prompts reference to a recommended procedure of long standing in SNB/JRB circles. Old hands in *Beechcraft* instruction offer a rule of thumb that the landing gear be retracted only when (a) a landing can no longer be effected on the runway or (b) an altitude of 100 feet is reached, whichever of the two occurs later. The altitude specified may vary with the command, but the principle of a "safe" altitude should be the determining factor.

CHECK LIST

MAG 11's highly interesting "Safety Bulletin" includes in its informal incident report form the following items: (1) I Goofed; (2) He Goofed; (3) They Goofed; (4) We Goofed; (5) Flight Violations; (6) Dangerous Flight Procedures; (7) Unsafe Practices; (8) (Other). Send or Deliver to the Group Safety Officer. — *Ed. Note:* The *Approach* is interested in receiving copies of squadron safety bulletin type publications—pleast put us on your distribution list!

PERSONAL COPIES AVAILABLE

The Superintendent of Documents, Government Printing Office, has made this magazine available to the aviation industry and the general public on a per copy or subscription basis. Subscriptions may begin with Vol. 1, No. 1, July 1955, and should be ordered from Supt. of Documents, U.S. Government Printing Office, Washington 25, D.C. Price 30 cents (single copy). Subscription price: $2.50: 75 cents additional for foreign mailing.

AVIATION VOCABULARY

New terms: *Burst Acceleration:* Throttle movement in one second or less from flight idle to 100% rpm. (From BuAer dispatch DTG 102121Z). *Chugging:* Momentary hesitation of engine at any RPM accompanied by audible pulsation not followed by RPM hang-up or EGT (exhaust gas temperature) rise above maximum allowable limits. *Compressor Stall:* Audible pulsation during acceleration occurring simultaneously with RPM hang-up or rapid rise in EGT above allowable limit. (From ComAirLant dispatch DTG 050032Z).

Introducing the

OLD PRO CLUB

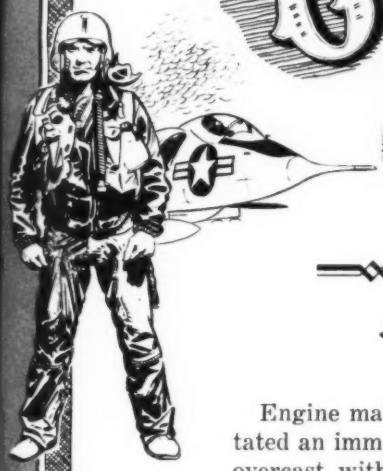
NAVAL aviation is correctly regarded as a rich source of examples of exceptional pilot ability—feats which range from dead-stick-flameout landings to grueling accounts of crippled aircraft being brought home under the skilled hand of a professional naval aviator.

Too often, however, reports of these instances are not circulated beyond the immediate area of occurrence. Thus, too often perhaps, the positive effect of these outstanding examples of applied aviation safety is overshadowed by the more negative impact of aircraft accident reports.

The Naval Aviation Safety Center considers that recognition of heads-up flying is essential to a positive program of flight safety. For this reason, and beginning with this issue, the *Approach* will acknowledge each month certain selected individuals whose exhibited flying ability merit inclusion in the "Old Pro Club" of naval aviators.

To assist the *Approach* in presenting a current, accurate roster, commanding officers are invited to submit nominees for selection. The report need consist only of a brief resume of the incident with pertinent personal data.

Those naval aviators whose names will appear on this page in future months may take justifiable pride in being selected to membership in naval aviation's most exclusive organization, with the added satisfaction of having made by their example, a *positive* contribution to aviation safety.



OLD PRO CLUB

ROSTER

John Burton Bain, Comdr., USN
Attack Squadron FIFTEEN
Aircraft: AD-6

Engine malfunction caused a loss of power and necessitated an immediate landing. Descent was made through an overcast, with an ADF approach to a civilian field. Landing was made without incident, damage or injury.

James K. Bourland, Lt., USNR-R
NRA VF 923, NAS St. Louis
Aircraft: F9F-4

On his first familiarization flight severe engine vibration from compressor bearing failure required immediate flameout pattern at idle RPM. Touchdown was made 500 feet down runway and aircraft came to stop after 5000 feet of rollout. No damage or injury.

Anton Mathew Campanella, Lt.(jg.), USNR
VF 51
Aircraft: FJ-3

An engine malfunction necessitated securing of engine and flameout approach from 20,000 feet. Normal flameout approach rigidly adhered to and touchdown made 1500 feet down runway for unarrested landing with no injury or damage.

Francis L. Lagen III, Lt., USN
HU-2 (Det 73)
Aircraft: HTL-4

Engine malfunction during ice reconnaisance forced an immediate landing. Helicopter landed on edge of an ice island 50 by 10 yards. Effective runway length was 25 yards, with ice outcrop obstacles. Landing was accomplished without damage or injury. The aircraft was later hoisted aboard ship.

WELL DONE

Lt. Comdr. John C. Bowen

WHILE on a P4Y-2 reserve training flight, during which he was giving a copilot approach-to-stalls instruction, Lt. Comdr. John C. Bowen, was alerted by the plane captain that a jet aircraft was closing rapidly from 2 o'clock. Simultaneously confirming and reacting to the warning, Bowen and his copilot nosed the P4Y down to avoid a collision. The other airplane, an F-94C, struck the starboard wing of the *Privateer* and sheared off some 10 feet, losing its own tiptank in the process.

The P4Y went into a right diving spiral, recovery from which was made only by full left wing down aileron and rated power on the starboard engines, plus a small amount of flap to bring the right wing up. By cautious experimenting it was determined that buffeting occurred at 160 knots and that at 145 knots the right wing tended to drop. Therefore the pilot concentrated on maintaining 150-155 knots, with full left aileron.

Because portions of the wing skin were flapping and because of the questionable integrity of the wing spar, it was decided that no maneuvering be attempted. Level flight was impossible to maintain and a rate of descent of 500 fpm was established. Bowen had directed the crew to bailout immediately after the collision, but time and altitude did not permit. Crewmembers then went to ditching stations as the pilot made the decision to land straight ahead in a "vast expanse of level fields."

Landing wheels-up, flaps-up, at about 145-150 knots, slightly nose-up, the plane slid smoothly to a stop in a thick cloud of dust. No fire followed the landing and an orderly evacuation was made with no serious injuries.

The jet pilot and observer, unaware of the collision believed that the loss of the tiptank was the result of a malfunction.

Although the accident board concluded that the collision resulted from cockpit preoccupation of both pilots, it also said: "Considering the large section of wing torn from the P4Y and the impaired control and flight characteristics, Bowen did an outstanding job of airmanship in landing his plane without injury to personnel."

To this the Naval Aviation Safety Center is pleased to add a "Well Done" to Lt. Comdr. Bowen and his crew, and cites this accident as impressive evidence of the increased need for lookout vigilance in aviation which more each day, moves "faster than you think." ●